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ABSTRACT

The overall goal of the Education Satellite Communications Demonstration is to design a framework for the analysis of the potential utility of satellites to education in this country. Within this framework, Phase 2 sought to identify research which would be clearly related to educational goals that might be worthy of attainment. The entire research design investigation was viewed as a policy analysis. The technical narrative section of the final report of Phase 2 begins with an introduction and overview and also includes an analysis of: legislative and legal research; organizational research; fiscal organization, demand, and utilization; and federal policy issues and options. The second half of the report covers proposed operation strategies including: (1) advisory council, (2) internal review, (3) dissemination, and (4) personnel. (WCM)

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May 20, 1974

DESIGN FOR THE ASSESSMENT AND POLICY ANALYSIS OF THE EDUCATION SATELLITE COMMUNICATIONS DEMONSTRATION

PHASE II FINAL REPORT

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Educational Policy Research Center
Syracuse University Research Corporation
1206 Harrison Street
Syracuse, New York 13210

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PART A

TECHNICAL NARRATIVE

SECTION 1

INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

The EPRC has designed a framework for the analysis of the potential utility of satellites to education in this country. This framework represents a number of conclusions and decisions we have reached while struggling to make sense out of the incredibly large number of interrelated problems, issues, and alternatives which we and others have uncovered. For the most part, the difficult yet essential decisions involved the discovery of sensible and legitimate ways of reducing the number of variables to be considered. As someone else has noted, much of our work during this design phase has resulted in the rather unspectacular decision not to do a variety of things. This phase has included both the exploration of what turned out to be false leads on how to handle the problem, as well as the more orderly and considered judgments about the range of issues we could most profitably focus on in the course of a two-year investigation.

1.2 WHERE WE BEGAN

We started with our preliminary proposal. In that document, we stated the guidelines by which we would develop the design for a comprehensive policy analysis of educational satellites. We also expressed our strategy and criteria for the examination of the Education Satellite Communications Demonstration. The opportunity we have had to examine these issues further has lead us to conclude that our original guidelines were sound. The following points from our preliminary proposal were reinforced by our later thinking:

(1) By way of a realistic perspective on ourselves and our task, we have taken the view that neither the Education Satellite Communications Demonstration nor our more general investigations will in any substantial manner lay to rest the

issues, questions, and disagreements over the educational potential of telecommunications. Conclusiveness and consensus are simply not common traits of studies of social change. Rather, it is our intention to devise careful and selective investigations which will serve the twin objectives of substantially improving and clarifying the on-going discussion and debate over the issues, while offering a better basis for making the allocative, legislative and other decisions which must be made one way or the other no matter what the state of knowledge.

(2) The entire investigation will be an extended and intensive policy analysis. There will be one central policy question which will serve as the cornerstone for all other decisions about what to examine and how to examine: what should the Federal Government's stance be with regard to educational satellites and telecommunications?

(3) The Education Satellite Communications Demonstration should be assessed and examined from the perspective of generalizeability. We are not, in our professional policy analysis context, concerned with whether or not the demonstration projects are successful in meeting their objectives. What we are concerned with is discovering the ways in which the experience of these demonstrations, or wisdom gained from that experience, is generalizeable to other, future circumstances. This, to us, is why such demonstrations are funded. We should examine the actual uses of telecommunications in these three experiments so that light can be shed upon the potential use and abuse of such technology.

Clearly, much that occurs in the demonstrations is idiosyncractic not only to the particular geographic regions, but also to the particular sets of administrators, teachers, programs, time-lines, hardware, and so forth which are involved. Our task is to glean from the complex, highly interrelated set of variables those events and relationships which seem to offer guideposts for future possible applications of educational telecommunications.

(4) We do not see the ESCD, or this particular ATS-F satellite configuration, as the only useful source of data for informing answers to the questions which are of concern. There have been other instances where satellites have been used for educational purposes. Furthermore, there have been non-satellite, mass and telecommunication experiments and programs which have some characteristics in common with satellites. Clearly, all legitimate experience and evidence should be brought to bear on the central policy questions.

(5) We were initially unsure how much attention could fruitfully be devoted to examining and assessing the learning outcomes of the ESCD projects. Our initial stance was one of some skepticism. We felt that the problems of statistical attribution would be quite considerable. Our further consideration has lead us to be even more pessimistic about the benefits to be gained from examining the learning gains. We think it would be most difficult to tell how much of such gains should be attributed to the new programs which have been developed for this demonstration or to changes in teacher performance and how much should be attributed to the new mode of delivery.

Furthermore, there have been a number of fairly comprehensive studies of alternative modes of delivering or presenting instruction. Such studies have not found substantial differences in learning outcomes which could be ascribed to the medium of communication. These studies have included televised instruction within their purview. And we have not been able to discover characteristics of the three demonstration projects which would suggest that they posses the essential ingredients for a major breakthrough in learning outcomes. Since this is a most crucial point, we will dwell upon it in greater detail below.

1.3 WHAT WE HAVE DEVELOPED

It was very clear to us that the sine qua non for a successful investigation was the development of a conceptual basis for our own work in Phase III. It was equally clear that we had to be quite comprehensive or else our work would not represent reality. But it was also obvious that there were dangers, probably fatal ones, if we were to be too comprehensive. Figure 1.1 and Figure 1.2 lay out the conceptual basis upon which our work will be organized during Phase III. They serve to summarize the priorities of the research and analysis which the EPRC proposes to undertake. This conceptual organization has been divided into three related categories:

(A) Policy Goals
(B) Research Areas
(C) Federal Policy Options

These categories will be discussed only briefly here, and will, of course, be dealt with more thoroughly in the following sections.

(A) Policy Goals

One recurring feature of forays into technological problem-solving is that there is almost never debate over the appropriateness of the goals and of the appropriateness of the technology for that particular goal. Too often "our inventions . . . are but improved means to an unimproved end. We are in great haste [to connect] Main to Texas; but Main and Texas, it may be, have nothing important to communicate."[*] It is our belief that telecommunication projects have a better chance of success when the goals are clearly articulated and articulated in terms of the ends to be served, not merely in terms of the means.

The list of policy goals which follows represents our understanding of the primary objectives or potentials of an educational telecommunications system. They are:

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[*] Henry David Thoreau, 1849.

	Research Areas: Opportunities/Constraints in terms of:			
POLICY GOALS	Cost/ Technical	Legislative and Legal	Organizational	Fiscal Organization, Demand, and Utilization Research Area
1. Cost saving considerations				
2. Provision of new or insufficiently developed services a) increased choice of programs at local levels b) improved access to certain services for, e.g., rural population, the handicapped, adults, etc. c) professional development, e.g., teacher training, medical training, etc.				
3. Increased opportunities for innovation and experimentation a) pedagogical innovation b) institutional development, e.g., open univeristy-type institutions c) regional organizations for educational and non-educational purposes d) international cooperation				
4. Improved modes of participation in a) educational decision-making and governance b) political process				
5. Preserve options and possibilities of education and social services--especially with regard to frequency allocation, channel allocations, etc.				

Different levels of analysis - International, Federal, Regional, State, School District, School, Community, Classroom, Home - will be considered where appropriate.

Figure 1.1

	Federal Policy Options, Roles and Leverage in terms of:				
POLICY GOALS	Leadership	R&D	Coordination	Programmatic Revision	Legislative Development
Cost saving considerations					
Provision of new or insufficiently developed services a) increased choice of programs at local levels b) improved access to certain services for, e.g., rural population, the handicapped, adults, etc. c) professional development, e.g., teacher training, medical training, etc.					
Increased opportunities for innovation and experimentation a) pedagogical innovation b) institutional development, e.g., open university-type institutions c) regional organizations for educational and non-educational purposes d) international cooperation					
Improved modes of participation in a) educational decision-making and governance b) political process					
Preserve options and possibilities of education and social services--especially with regard to frequency allocation, channel allocations, etc.					

ferent levels of analysis - International, Federal, Regional, State, School District, School, Community, Classroom, Home -
l be considered where appropriate.

Figure 1.2

1. Cost Saving Considerations

Ideally an instructional medium would be evaluated in terms of its potential in improving the quality of instruction. We have already indicated some of the reasons why we are not doing this. Past studies of alternative modes of delivering or presenting instruction have not found substantial differences in learning outcomes which could be ascribed to the medium of communication. Experimental results have been mixed and inconclusive. One experiment may "show" that above-average students learn more through ETV than with traditional instruction, while the next experiment "shows" that they learn no more than they did with conventional methods.

A recent review of the literature of the effectiveness of alternative instructional media suggests that the reason why experiments with new media have not produced increases in learning effectiveness could be because the uses made of the new media in those experiments have differed only marginally from traditional methods[**]. We have not been able to discover characteristics of the three demonstration projects which would suggest that they posses the essential ingredients for a major breakthrough in this area. Of course, we would be interested in observing and recording such breadthroughs should they occur. (See "pedagogical innovation" below).

It is further suggested in the review cited above that educators should be "exploring much more systematically the potential of technology to reduce system costs through productivity improvement." The escalating costs of the educational system is a well-known phenomena. Tax-payer "revolts" are becoming common. If telecommunications systems can be used to increase the productivity of the system, the benefits could be substantial. Of course, it is possible that negative side-effects might outweigh the benefits. Our research areas, to be described later, are designed to consider potential problems as well as opportunities.

[**] Jamison, et. al., "The Effectiveness of Alternative Instructional Media: A Survey," RER, Winter, 1974.

2. Provision of New or Insufficiently Developed Services

Clearly one of the goals of the ESCD is to demonstrate the feasibility of using a satellite system to provide services for rural populations which would otherwise be unavailable. Alaska, for example, needs a telecommunications network. Geographic and atmospheric conditions make the effective use of broadcast or cable TV impossible, and so the satellite is an ideal solution for Alaska.

The satellite frees us of spacial limitations. Thus, it becomes possible to aggregate dispersed individuals and groups and provide services to them cost-effectively. This goal of providing new services to special populations is an instance of the more general goal of providing equal educational opportunity for all our citizens. When thought of in this light, it is clear that rural populations are only one example of special groups who might be served by a satellite system. The handicapped, adults who want further education, and medical personel who need in-service training are other examples. The research tasks which we have proposed for Phase III are designed to help us determine which services a satellite or telecommunications system could most effectively provide.

3. Increased Opportunities for Innovation and Experimentation

Earlier remarks about our decision not the look at the ESCD in terms of improved learning outcomes should not be understood as suggesting that the medium of television has no potential for pedagogical innovation. Early attempts at using television seemed to be simply "televised instruction" rather than "instructional television." That is, we have simply used the television camera to record what teachers in classrooms ordinarily do, rather than devising more imaginative uses of the medium. The programs produced by The Children's Television Workshop point the way toward more effective uses and so, perhaps, does Computer Assisted Instruction.

The ability of a satellite system to free us from the usual geographic limitations has been noted earlier. One consequence of this could be to open possibilities for new forms of institutional development. A university for example, need not be tied to a set of buildings in a specific geographic location. Also, the ties may be loosened that bind our educational delivery system to political/geographic divisions such as the states. Regional organizations have played a large part in the ESCD. The creation of new sorts of regional, multi-state organizations and networks offers new possibilities for the delivery of social services and the solving of common problems. The examination of such new organizations is an important focus of the research studies we have planned for Phase III.

4. Improved Modes of Participation in the Educational and Political Decision-Making Processes

Frequently it has been suggested by Cable TV advocates that one of the advantages of the large number of channels and the two-way capabilities of Cable TV is a potential for increased participation in the political process. Meetings of the local city council, the school board, the state legislature, or the Congress could be televised. Opinion polls or referendums could be conducted swiftly. Such a vision may well be overly optimistic about the extent of the participation which would actually obtain. And there may be dangers connected with such uses of the system. Several issues of privacy are raised by two-way systems - surveillance, "cabletapping", and message tampering, for example.

Like Cable TV, satellite systems have interactive capabilities. Further, satellites could be used to link terrestrial systems having two-way capacity. Using telecommunications systems to increase participation in the political process is an important goal; the research we suggest would shed some light on its feasibility and desirability.

5. Preserve Options and Possibilities of Education and Social Services

It is an important goal of current efforts such as the ESCD to demonstrate that educators can make effective use of new technologies. In some cases this may lead private enterprise to see a new market for services they might otherwise have developed for non-educational users. In other cases, such demonstrations may lead to the carving out of areas of legitimate governmental intervention. In either case, it is important to keep the options open by making sure that education and other social services will not be "frozen out" in the early stages of development when frequency allocations, channel allocations, and so on are being made. The setting aside of national parks when there were lots of open spaces was an act of vision. Similar acts of vision may be required before the telecommunications network gets more and more firmly established.

(B) Research Areas

In planning what we would do during Phase III, the EPRC faced the task of somehow disaggregating a bewildering array of highly interrelated issues. The four research areas indicated in Figure 1.1 -- cost/technical; legislative and legal; organizational; fiscal organization, demand, and utilization -- represent the basic analytic units for the Phase III investigation. The studies which would be conducted within each of these research areas are described and detailed in the following four sections of this part of our proposal.

They are represented here as separate areas of research, but we are well aware that they are interrelated. For example, the regulatory policies of the FCC considered in the legislative and legal research area, have consequences for the growth of the telecommunications infrastructure, considered in the cost/technical research area. Nevertheless, we believe that these are four extremely important areas of research which must be conducted if we are to understand the opportunities for and constraints on realizing the policy goals detailed earlier.

(C) Federal Policy Options

The EPRC's entire investigation will be, as we have said, an extended and intensive policy analysis. The central policy question which would guide our Phase III work is: What should the Federal Government's stance be with regard to educational satellites and telecommunications?

As Figure 1.1 suggests, the four research areas previously described were selected and developed in order that they might shed light on the fundamental policy goals and issues. The next step will be to synthesize the results of our research and relate those results to the different actions and activities in which the Federal Government can engage with regard to educational satellites and telecommunications. Figure 1.2 represents our breakdown of these activities: leadership (without the use of dollars or legislative control), research and development, coordination, programmatic revision, and legislative development. This breakdown has been chosen because it appears to most readily conform to and mesh with the organization of the federal decision and policy-making apparatus. Our understanding of these policy options will be explained in Section 6 of this part of our proposal.

SECTION 2

2.0 TECHNICAL-COST RESEARCH AREA

The technical-cost investigation will focus on four component inquiries. The first will involve the creation of projections of the growth of the U.S. telecommunications system over the next five years, with special emphasis on the developments which will be or could be used by the educational system. The second investigation will be concerned with developing estimates of the future costs of hardware, with special emphasis focused on the future costs of ground equipment. The third investigation will develop an array of alternative technological changes which can be made in the future. Such alternatives will be based upon the prior two studies. That is, the alternatives will be viewed as "marginal' to the telecommunications infrastructure as it will exist five years from now. The point here is that the potential role of a satellite might be one thing given the current state of the telecommunications infrastructure, but might be quite different if, say, ITFS and cable television were to experience considerable growth over the next five years. We wish to establish what the "telecommunications givens" might be for that future marginal decision. The fourth component will integrate the other three components and consider how much the posited additions to the educational telecommunications system (hardware, software and personnel) would add to the total cost of educational budgets.

2.1 PROJECTION OF THE U.S. TELECOMMUNICATIONS INFRASTRUCTURE

The EPRC is wary of projections, especially ones upon which important decisions may be made. The Center has had considerable experience with futures methodologies and is well aware of the many pitfalls which surround such efforts. One of the greatest dangers is that the projections will be taken more seriously, viewed as more authoritative and accurate, than they should be. Notwithstanding these caveats, we feel that it would be most useful, perhaps essential, to develop some estimates of the growth of the

U.S. telecommunications infrastructure over the next five years. There appear to be two compelling reasons for making such projections. First, it seems clear that when examining the telecommunication options for education it is most important to have some idea of the nature and extensiveness of the future telecommunications system. This is especially true when one is focusing attention on the potential role of satellites. For instance, it seems clear that one of the major roles a satellite could play would be to serve as a means of linking existing terrestrial telecommunications systems such as cable television. Second, we feel that reasonably good estimates of the communications infrastructure are possible. These estimates are based upon several considerations. Physical and technological phenomena have generally been less volatile or more stable than social phenomena. Furthermore, one is assisted in making projections when lengthy planning and implementation periods precede the operation of a program or system. This is frequently, though by no means always, the case with telecommunications developments.

The EPRC plans to make five year projections of the following:

2.1.1 Public Broadcast Stations and Networks

Our investigation so far suggests that Public Television expansion is reaching the limit of the usefulness of expanding broadcast services. Reaching those as yet unreached by PTV in a cost effective manner will require new means. Cable television is being considered as one possibility. Our study will investigate the expected coverage of PTV and public radio during the next five years based on discussions with the Corporation for Public Broadcasting and the Federal Communications Commission. We will include radio in this study because of its current rapid development in the non-commercial area and its possible utility in many educational situations. (Here less developed countries and their practices may provide some insights.) We will also consider the availability of transmission time during the day and during the night, for delayed transmission services.

2.1.2 Commercial Broadcast Stations and Networks

This study will consider the possibility of utilizing commercial broadcast time, both on a paid and unpaid basis. We will investigate possible changes in the rate structure of commercial broadcasting and the incentive structure which would make commercial broadcast an attractive proposition for education purposes.

Most significant, perhaps, will be an investigation of the ways in which unused broadcast capacity, in the early morning, and side band services, might make transmission a feasible proposition.

2.1.3 Cable Television Networks

It appears that the spread of cable television has had an unexpected slow-down, expecially in the large cities. For this reason we will be considering the possible future spread of these systems with a great deal of caution. We will be obtaining data on the demographic and geographic nature of persons and institutions now served by cable television systems. For a whole host of reasons we expect that CATV will initially penetrate those areas where there are relatively affluent populations. Given these characteristics of the medium and its audience, we will be better able to consider the possible roles which CATV might play in any educational telecommunication system.

We will also consider CATV from the standpoint of interconnection. Already Multiple System Operators and other private enterpreneurs are developing plans for interconnection. As the possibility of widespread interconnection of systems becomes feasible, CATV will become an important factor in the delivery of large-scale educational communications.

2.1.4 Hardware and Software Within Schools

For twenty years schools have made large capital investments in a large variety of hardware and software. This study will consider the range and extent of this hardware and software within schools. We expect that data of this sort will be readily available from the Association for Educational Communications and Technology, the Joint Council on Educational Telecommunications and the U.S. Office of Education. We would wish to discover, for example, the incidence of instructional television fixed services, intra-district CATV, broadcast instructional television, closed circuit instructional television, video tape players and recorders, television receivers and computer facilities. We would also be interested in the range of holdings of various kinds of instructional materials and computer software. The prior existence of possibly large investments in these areas would have significant consequences for the kind of interconnection services which are both desirable and possible. Good data is available from trade sources on the past and current expenditures in most categories described above.

2.2 PROJECTION OF HARDWARE COSTS

This part of the study has two foci. The first is an examination of terrestrial information distribution systems, both electronic and packaged and the second will examine crucial cost-factors in satellite and associated equipment. The caveats expressed in the previous section about the limitations of projections apply with equal force to the cost projections which will be formulated in this section. The reason for including this task is that our preliminary inquiries during Phase II have led us to suspect that the cost of some equipment, especially terrestrial equipment, might be subject to substantial reduction over the next five years. If this proves to be correct, it could have major implications for the attractiveness and feasibility of several of the alternative educational applications of telecommunications.

2.2.1 Terrestrial Distribution of Information

This part of the study will consider the growth and consequences of two kinds of information transmission modes - electronic transmission such as microwave or long-line transmission with the second being packaged transmission such as video tape.

2.2.1.1 Electronic Transmission

As satellite-based communications take over many of the services which were largely operated via land-lines, and as microwave carriers develop their services, we expect quite drastic movements in the rate structures for the transmission of all kinds of information. For the first time in many years a somewhat open market will determine rates for services. The ambiguity of the situation during the next five years makes it all the more important for us to carefully evaluate the consequences of rate fluctuations for the non-commercial sector.

2.2.1.2 Packaged Information

This aspect of the study will involve consideration of developments in the packaging of information. We will consider, for example, cost projections on the various video-tape formats and the associated playback equipment.

2.2.1.3 Projection of Satellite Hardware Costs

Since the value of satellites for education depends on reaching a massive and diverse student population, large channel capacity systems utilizing relatively small low-cost earth station terminals (6 - 12 ft. diameter antennas) with high powered communication satellites are of special interest. While it might be technically feasible to broadcast program material direct to individual receivers from the satellite on a limited basis, the use of 15 - 18 ft. diameter antennas and sensitive (low noise) receiver front ends at the institutional level or in conjunction with cable television systems (CATV), public broadcast (PB) and instructional television fixed service (ITFS) could greatly increase the number of channels* (see section 2.3).

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*We fully recognize that alternative learning hardware/software systems utilizing voice only, digital data, and slow-scan TV can dramatically increase the information carrying capacity of each video channel and intend to extensively study the performance and cost of these systems. Since such smaller bandwidth channels can be viewed as being multiplexed into the spectrum space of a single TV channel, so we shall concentrate our subsequent discussion on the number of equivalent video channels.

Consequently, a number of tradeoffs are possible between the space and earth components; the crucial parameters and their interrelation can be expressed in a satellite to receiver output equation as follows:

$$\text{EIRP} + (A/T_S) + I_R = (S/N)_0 + M + (\text{Constant})$$

EIRP	(A/T_S)	I_R	$(S/N)_0$	M
Satellite Effective Radiated Power	Ground Station Figure of Merit	Receiver Noise Improvement	Required Picture Quality Signal To Noise	System Margin

NOTE: all units are in decibels (dB).
The EIRP is [illegible] dBw or dBm.

The right hand side of the above equation consists of the signal-to-noise sensitivity required for high quality video reception, either for terrestrial rebroadcast (55 dB) or for direct reception (45 dB), and any system margin for deterioration of satellite radiated power with age, ground station antenna pointing errors and anamalous atmospheric loss, etc. The levels of the three components on the left hand side can be adjusted by the system design to minimize total system costs for a given channel capacity.

Because current satellite power (EIRP) is limited and the costs of earth stations are directly proportional to the ground station sensitivity, A/T_S (the antenna area divided by the system noise temperature), currently large receiver noise improvements are needed to offset the smaller values of the two parameters. The degree of noise improvement is dependent on the modulation technique used to transmit over the satellite link, whether it be frequency modulation (FM) or digital pulse code modulation (PCM). In all cases, this noise improvement is attained by significantly expanding the transmitted channel bandwidth. For example, the Canadian 'Anik' educational satellite system uses frequency modulation to expand the 4.5 MHz video bandwidth to a 36 MHz channel bandwidth which yields a 22 dB noise improvement.

We plan to focus special attention on projections of performance/cost breakthroughs in satellite subsystems components and modulation techniques (EIRP, I_R related) and earth station antennas and receivers (A/T_S). Particular emphasis will be placed in the latter since it is here that major cost-performance breakthroughs appear to be possible. Because of the large numbers of potential education-related earth stations, this will have a substantial influence on system costs and, more importantly, the use of a larger ground station figure of merit (A/T_S) for the same cost will yield a corresponding increase in the channel capacity since a smaller receiver noise improvement (I_R) will be required. In the same light, since system costs are less sensitive to satellite-in-orbit costs, it is important to assess the credibility and impact of anticipated factors-of-2 improvements in satellite EIRP (due to sun-oriented solar cell arrays, increased solar cell and transmitting tube efficiencies) in enlarging channel capacity.

Ultimately, it may be possible to achieve satisfactory reception with a receiver noise improvement of zero, i.e., no bandwidth expansion; this then would allow the use of traditional amplitude of the video, and a channel capacity of 100 video channels per 500 MHz band which the FCC has allotted in the existing and proposed domsat frequency bands. Whether or not this will be found to be practically achievable in the near future is at present unclear; in any case it is important to assess the technology for reducing this bandwidth expansion and raising channel capacity.

We feel that visits to companies that develop satellite subsystems, earth station equipment, and related components such as low noise amplifiers, transmitting tubes, solar cells, antennas and so forth, are essential in assessing potential breakthroughs. The limited sampling that we have been able to do, convinces us of the need for person-to-person contacts in gleaning data for forecasting the status of technology--even a few years into the future. Most relevant published papers emerge at least a year after completion of the work on which they report. Furthermore, the reputable scientist or technologist is not inclined to speculate in print or by letter (even comments on the telephone are often somewhat guarded), yet only the person actively working in the forefront of a given field is competent to extrapolate from what is now to what may be.

A second problem in forecasting has to do with recognizing the distinction between what is being done now in the laboratory with painstaking care and what can be done in a production facility with moderate operator skills and a moderate expenditures of time and money. It should not be surprising that the technologists associated with industry are better able than academic researchers to make this distinction and to translate its impact into time-lags and probable production costs.

Finally, it is important to recognize that even the very competent scientist or technologist may find it difficult to distinguish the high performance, extreme-reliability demands placed on military and aerospace apparatus from the relaxed-reliability low-price demands placed on consumer electronics. Our attempts to make a quick preliminary estimate of the prospects for low-cost receiving stations for direct reception led first to discouragingly high cost estimates from persons associated with military/aerospace equipment development. Further probing among those with experience in consumer electronics produced a far more encouraging picture. Obviously, the study we plan will put us in a position to judge where the truth lies.

2.3 DEVELOPMENT OF ALTERNATIVE SATELLITE SYSTEMS

Results of the preceding sections should provide the groundwork and context for the conceptualization and cost/performance analyses of alternative satellite systems that might be created. It is quite clear from our initial analysis, described in Appendix 2A, that a virtually limitless number of alternative telecommunications configurations are possible. For instance, satellites can use: (1) a broad receiver antenna beam to collect programming from widely separated locations and a broad transmit beam to cover the entire nation; (2) a broad beam on receive as above and a narrow spot transmit beam to serve a limited region; or (3) a spot transmit and receive beam for regional operation only.

Faced with this degree of variability, we have found it necessary to compress the number of alternatives by developing prototype or archetypal systems. We have arrived at three basic models which have been differentiated according to their differing terrestrial utilization. Because satellites with spot beam and broad beam transmitting antennas can have substantially different video channel capacities at a particular earth station, it is important to enumerate the cost-channel capacity tradeoffs within each archetypal system. Table 2.1contains a summary of potential channel capacities and ground station costs based on current technology and credible cost breakthroughs for a 4-satellite spot or broadbeam system for the U.S.

System I is based upon the assumption that there will be terrestrial retransmission of signals. Signals transmitted to the satellite from regional or national originating sources are in turn received by public broadcast, cable television and ITFS facilities for rebroadcast to the eventual users, whether they be in homes or institutions. This system calls for relatively fewer earth stations, making it financially feasible to use a single servo controlled receiving antenna, the total (48/96) channels available from the four broadbeam satellites would be accessed sequentially, with (12/24) channels available at any one time. Lower cost, fixed antennas can be used with the spot beam satellite; the lower cost is achievable, however, by sacrificing access to channels carried by the other three satellites.

System II would involve direct satellite-to-institution transmission, where institutions might include schools, hospitals, factories, prisons, and office buildings where programs would be distributed over simple closed circuit

TABLE 2.1

CHANNEL CAPACITY - GROUND STATION COST TRADEOFF FOR 4 SATELLITE SYSTEMS

	Video Channel Capacity	Cost Per Ground Station
SYSTEM I		
Spot Beam	12/24*	$12K
Broad Beam	48/96	$82K
SYSTEM II		
Spot Beam	12/24	$ 3K
Broad Beam	48/96	$ 5K - SERVO $20K - 4 Fixed Antennas
SYSTEM III		
Spot Beam	12/24	<$.5K
Per Satellite In Orbit Cost	$20M/30M	
Per Receiver Costs	<$.5K	

---

*24 Channels available with multi-frequency band or polarization diversity.

TV facilities. This model would involve a considerably larger number of ground receivers than System I. Because the received signal is not rebroadcast, the less severe requirement on S/N permits a less sensitive, and hence, less costly receiving apparatus. For the spot-beam case, the low cost of the ground station with a single fixed antenna looks especially attractive, if one can be satisfied with (12/24) channels. At a slightly higher ground station cost, the broadbeam satellite configuration makes available the entire set of (48/96) channels through sequential selection of the four groups of (12/24) each by means of a servo controlled antenna. At a still higher cost, the entire set of (48/96) channels becomes available simultaneously through the use of four fixed antennas per ground station.

System III would involve direct satellite-to-home (or school, person) transmission. This system can succeed only with a low-cost ground station, which in turn demands the higher signal strength of a spot-beam. The ultimate in cost reduction will depend on large volume sales with perhaps some sacrifice in reliability as compared to the demands made on the receive terminals associated with institutions.

2.4 TOTAL MARGINAL COSTS: COMPONENTS FOR PROGRAM BUDGETS

This task will serve, in part, to bring together the preceding studies. We focus on marginal costs, again, because we want to know how much the posited additions to the educational telecommunications system (hardware, software, and personnel) would add to the total cost. Clearly, some of these additions could replace existing services and activities, while others might utilize existing services and activities. As such, they would not add to costs (though they might cause other problems which will be analyzed in the succeding sections). Others of these additions would involve net cost increases and it will be our purpose in this investigation to measure them.

In formulating these cost estimates, it is our intention to develop the basic "building blocks" which would serve as the basis for estimating the marginal costs of a wide range of alternative satellite-telecommunications programs. Built-in to these estimates will be the basis for comparing the relative costs and technical performances of satellite as opposed to non-satellite telecommunication systems. In the preceding sub-section on alternative marginal telecommunications systems we have developed three prototype systems, emphasizing that they will be designed and elaborated so that hybrid systems can be explored. These prototypes and their hybrid variations will have different cost structures associated with them. Our purpose in this section of the investigation will be to develop the basis for estimating these further costs, and making comparisons among them.

Clearly there are a large number of different ways the costs could be disaggregated. The EPRC has decided that the most useful way to do so would be to develop three major categories which will, in turn, be disaggregated: hardware, programming, and staffing. It is expected that this method of cost analysis will provide the basic components for estimating the net expenses associated with a wide range of alternative satellite telecommunications systems. It will also provide the basis for analyzing net or marginal costs or cost savings. That is, by breaking down the costs according to hardware, programming, and staffing costs, it will be possible to estimate how much of the total cost of the total required inputs can be met by facilities, equipment and personnel already existing in the schools, school districts, state education departments, and so forth. For instance, some of the television sets, video tape equipment, audio-visual technicians, and management expertise will already exist to varying degrees in the different school districts and state department of education. The task of the cost analysis is to discover how much the alternative telecommunications systems could utilize or substitute for these existing costs.

2.4.1 Hardware Costs

This part of the analysis will be based almost exclusively on the work done in the preceding three sections in which we estimated future trends in the telecommunications infrastructure, future costs of hardware, and developed three alternative prototypes for satellite telecommunications systems. This section will, in a sense, serve as a summary for the hardware components of these investigations, and will examine the hardware according to three categories: satellite, terrestrial but non-school, and in-school hardware.

2.4.2 Programming

The major focus of this study will be on costs associated with the development of audio and visual materials which would be suitable for use in some kind of telecommunications system. We will also consider the use of associated materials such as reading guides, and the costs which they will introduce.

We also plan to develop cost data on various kinds of programming. We would wish to see whether there was any relationship between the quality and cost of production and likelihood of re-use. Obviously those factors would be significant in overall cost considerations.

Our plans also call for consideration of the ways in which new author languages might impact on the production costs of various modes of computer based instruction.

The EPRC will also examine the costs incurred by the ARC, Alaska, and FRMS demonstrations in the development of programming. The purpose will be to examine the range of costs incurred by these three demonstrations in order to develop indications of what "locally or regionally produced" programming can cost. These experiences may well be of some interest since other groups may in the future be confronted with instances where they wish to develop programs uniquely tailored to their own special populations. We would also wish to speculate on the possible return use - repeated use - of such material in order to gain some sense of how the costs can be shared through time.

2.4.3 Operational Staff and Staff Support Costs

The major substantive effort of this section will be to estimate the costs of the human resources which would be required or would be useful in operating an educational telecommunications system. This study will be based upon the alternative telecommunications prototypes developed in the preceding section. It will also gather inputs from the analytic section below on the organizational and institutional arrangements involved in educational telecommunications systems. In so doing, staffing categories will be used which correspond to those used by the Federation of Rocky Mountain States:

Management
Broadcast and engineering
Utilization
Research and evaluation
Ancillary services

We are not including the program development activities in this sub-investigation, since they will be covered by the preceding analysis.

At this point it appears that the FRMS accounting system is well developed and will provide the best basis for such detailed analysis. The EPRC plans to disaggregate costs according to the organizational levels developed in the Organizational Study:

Regional
Intermediate
Local

An advantage of concentrating on the FRMS/STD is that their investigations on the functioning and efficacy of their field staff will provide a useful base for initial indicators of the utility of such activities. It should also provide some indications of the range of "start-up" problems which other groups might expect to encounter in the future.

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APPENDIX 2.A

2.A.1 INTRODUCTION

In proposing system configurations for a satellite educational system and developing a first order estimate of their costs, there is a risk of overestimating the technical feasibility and underestimating costs since satellite and earth station systems cost/performance data are not established and many of the potential services are new, untried, and therefore, of uncertain value. Nevertheless, based on our experience, an extensive literature survey[*] and direct contact with satellite communications consultants, and earth station equipment and component manufacturers, we have attempted to summarize performance and cost estimates for the two satellite options: (1) spot beam and (2) broad beam systems.

In a broad beam system, depicted in Figure 2.A-1, the satellite's transmitting antenna is specifically designed to illuminate the continental U.S. The satellite's directive transmitting gain[**] is limited to approximately

$$G_{BROAD} = \eta \frac{4\Omega}{\Omega_{USA}}$$

where η is an efficiency, perhaps of the order of 0.5 and Ω_{USA} is the solid angle subtended by the continental U.S. at the satellite. Approximating the U.S. surface by a 2600 x 1700 square mile rectangle tipped at an angle of 40° (mean latitude angle) one gets

$$G_{BROAD} \simeq 30 \text{ dB}$$

If the total RF power capacity of the satellite is P_{Total}, the available transmitted power density per channel (EIRP) is equal to $(P_{TOTAL} G_{BROAD})/C$

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[*] A partial listing of the literature which was particularly helpful in our preliminary study of the educational satellite system hardware options appears at the end of this appendix.

[**] The antenna gain > 1 is a measure of its energy-focusing capability.

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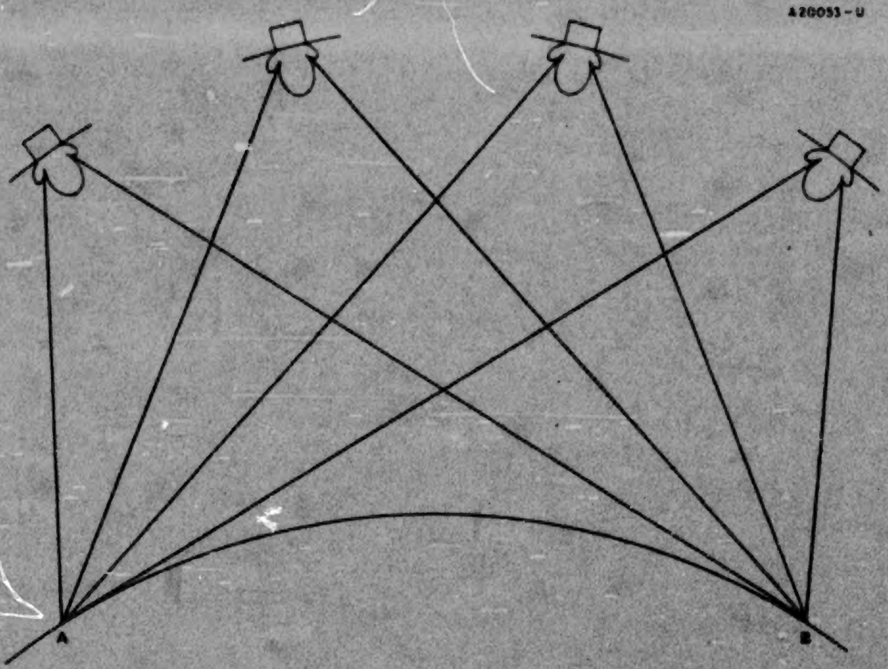

Figure 2.A-1. Broad-Beam Coverage

were C is the number of communications channels. We indicated in Section 2 that the maximum allowable C will depend upon the sensitivity/cost of the ground stations, the required reception signal-to-noise ratio, and the required receiver noise improvement factor.

If, on the other hand, a plan is devised whereby a given beam covers only a fraction, f, of the continental U.S., the satellite transmit gain and EIRP increases by the factor (1/f) or -10 (log f) dB. With four such spot beam satellites sharing the coverage as depicted in Figure 2.A-2, the antenna gain-EIRP increases by 6 dB to 36 dB. This can be translated into a lighter burden on the ground stations, or, leaving the ground stations unchanged, the number of channels per beam can be increased. However, since receiver noise improvement is a rapidly decreasing function of C, Equation 1 in Section 2 will not permit a substantial increase in channel capacity.

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Suppose the four satellites are each given dual-beam capability (either by means of dual antennas or by dual feeds above a single reflector), so the fraction now becomes f = 1/8. Now G_T is doubled, but the available RF power, P_{TOTAL}, on each satellite must be shared between two beams. The available power per beam at the earth's surface is, of course, no different from the value of the preceding case, but the total area has been broken into smaller regions, thereby permitting greater independence of programming.

The most severe constraint to providing a large video channel capacity is the limited 500 MHz total system bandwidth which is a consequence of current CCIR/FCC frequency allocations. As discussed in Section 2, the substantial receiver noise improvement factor required in Equation 1 is achieved by expanding the 4.5 MHz video bandwidth by frequency modulation (FM) to approximately 40 MHz with the consequent effect of limiting the number of video channels to 12. Other alternatives that can be used to obtain additional satellite channels are: (1) multiple frequency bands, e.g. 4 and 12 GHz (for the satellite-earth link), in conjunction with multi-frequency earth station antennas; (2) polarization diversity, a technique utilizing special antennas to transmit, receive, and seperate two orthogonally polarized signals. Each of these techniques, nevertheless, requires a factor of two increase in satellite prime power.

2.A.2 SPOT BEAM SYSTEM PERFORMANCE/COST

Consider the particular spot beam system depicted in Figure 2.A-2 with separate satellite beams utilizing the same downlink and uplink frequencies. Interference between beams is avoided by using a combination of polarization diversity and/or frequency diversity (e.g., 4 and 12 GHz downlink frequencies). Additional multichannel increments can be obtained from additional satellites using the directivity capability of the ground station as indicated in Figure 2.A-3 to sequentially focus on a particular satellite or instantaneously with multiple fixed antennas.

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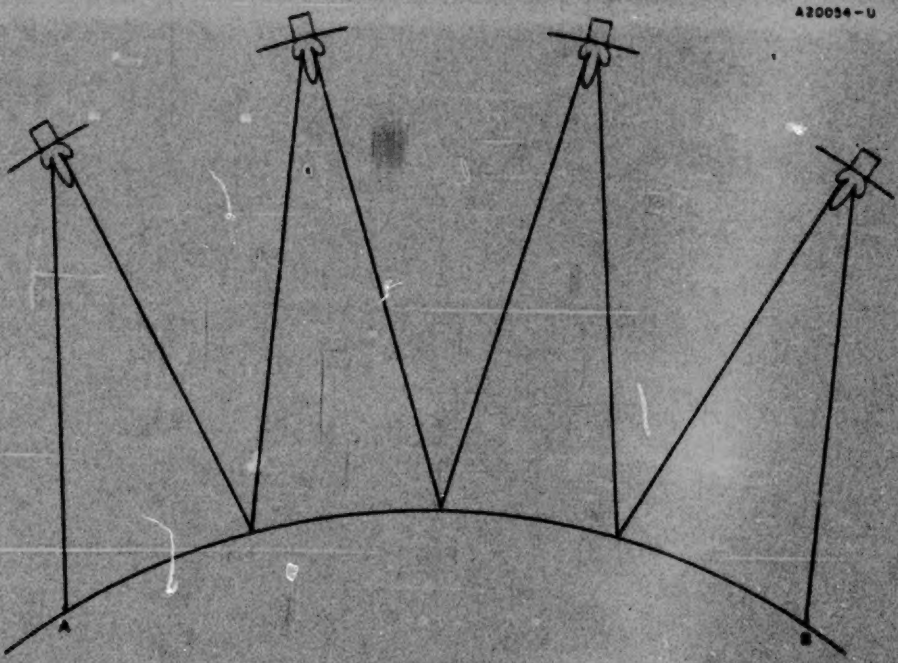

Figure 2.A-2. Spot Beam Coverage

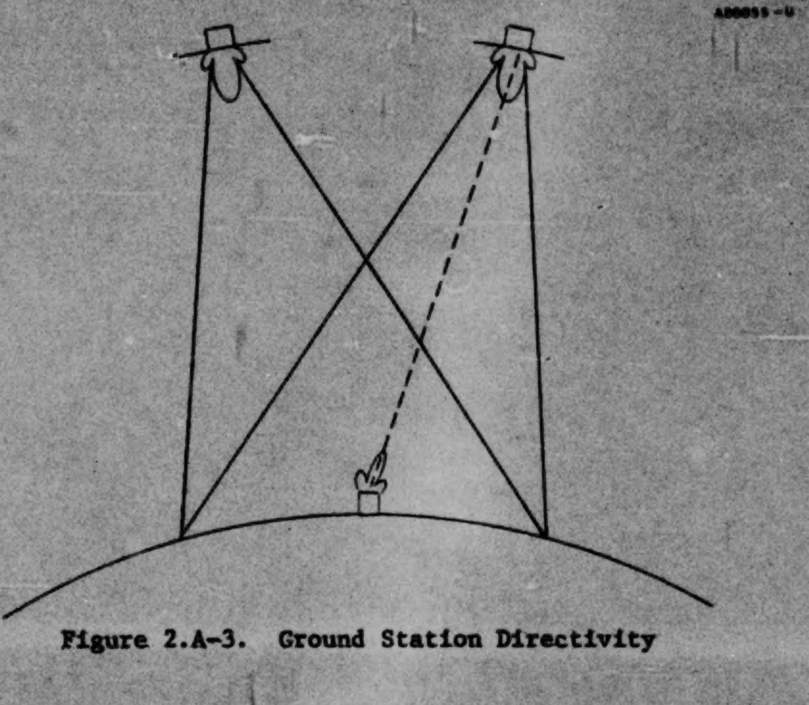

Figure 2.A-3. Ground Station Directivity

The pertinent system parameters and component costs based on current technology are summarized in Table 2.A-1. The ground station G/T figure of merit assumes a downlink frequency of 4 GHz although other frequency bands such as 12 GHz would yield essentially the same costs. A TASO Grade 1 (excellent) quality TV reception is used. A 10 dB higher-gain receive antenna (30 ft diameter) is required to attain the CCIR standard 55 dB SNR for TV rebroadcast. This increases the ground station cost to $20K. The approximate cost of a comprehensive transmit-receive station to distribute programming via the satellite system is approximately $100K. A 2.5 dB excess margin is included in the analysis to insure high reliability over the satellites 5-7 year service life.

The parametric amplifier, FM receiver and antenna costs reflect the current suppliers' off-the-shelf equipment assuming limited quantity orders. A factor of 2 reduction in today's costs could be anticipated for large orders. The Japanese developers of a new ground station preamplifier and FM demodulator claim a substantially reduced cost to in the neighborhood of $150. If this estimate is realizable--and many scientists think that it is likely--direct satellite broadcast to the home is a reality with a spot beam satellite. During the hardware cost projection phase outlined in Section 2, we intend to thoroughly investigate this claim.

2.A.3 BROAD BEAM SYSTEM PERFORMANCE/COST

The broad beam system has the potential for significantly increasing the satellite educational system channel capacity. Consider four satellites (the same number assumed for the spot beam system) providing overlapping coverage of the U.S. A given ground station uses antenna directivity* to access desired programming available from a particular satellite as illustrated in Figure 2.A-3. Table 2.A-2 summarizes some of the significant features of this system (which is similar to the Canadian "Anik" SES).

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*Automatic, accurate, fixed antenna pointing could be readily implemented at modest cost. Speed is not an important factor.

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TABLE 2.A-1

SPOT BEAM SYSTEM

System Parameters	Current Technology Parameters	System Component Costs
Video Channel Capacity (per Region)	12 Channels	
Total Satellite Channels	24 Channels	
Total Satellite RF Power	120 Watts	In Orbit Satellite Cost $30M
EIRP* (2° Beam)	44.5 dBw	
dB Excess Margin (Errors & Propagation Effects)	2.5 dB	
Ground Station (Receive Only)		
G/T Figure of Merit**	14 dB/°K (TASO Grade 1)	Ground Station Costs
System Noise Temp (Parametric Amplifier)	500°K	$1.5K
Receive Antenna Gain	40 dB	
Antenna Diameter	7 ft	$1.5K (Antenna)
		$3.0K per Ground Station
FM Receiver Terminals		.5 K

Total Cost = $\$(3.N_{GS} + 0.5\ N_T)K$

N_{GS} = # Ground Stations

N_T = # Terminals

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[*] Effective Isotropic Radiated Power per Channel

[**] Receive Antenna Gain Divided by System Noise Temperature

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TABLE 2.A-2

BROAD BEAM SYSTEM

System Parameters	Option 1	Option 2 (Polarization Diversity)
Video Channel Capacity	12	24
Total Satellite RF Power	120 W	240W
In Orbit Cost	30M	40M
EIRP	36 dBw	(Remainder is same)
dB Margin	2	
Ground Station (Receive Only)		Ground Station Costs
G/T Figure of Merit	18 dB/°K (TASO Grade 1 3/4)	
System Noise Temp (Paramp)	500°K	\$1.5K (Paramp)
Receive Antenna Gain	44 dB	
Antenna Diameter	12 ft	\$3.5K \$5.K*
FM Receiver Terminal		.5K

Total Cost = $\$(5\ N_{GS} + 0.5\ N_T)K$

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*Minimal increase in cost anticipated for reception and separation of cross polarized components.

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In this example, each ground station has access to 48 or 96 video channels although once the antenna is positioned, only 12 or 24 channels are received at a particular time. The startup phase is simplified since the system capacity grows gracefully from one satellite to multiple satellites. There are obvious reliability and redundancy properties since a satellite failure will not black out a particular region until another spot beam satellite is launched.

A crucial assumption implicit in the results in Table 2.A-2 is that a TV picture quality with essentially a TASO rating of fine (75%) to excellent (25%) is acceptable system performance.* Increasing the picture quality to a TASO rating of excellent (SNR = 45 dB instead of 40) increases the receiver antenna size to 24 ft resulting in an atenna cost of $11.5K instead of $3.5K. Increasing receiver antenna size to achieve a CCIR rebroadcast quality picture would result in a 60 + ft antenna costing $80K. However, using a 12 channel broad beam system with 240 watts RF power will raise the picture quality to TASO 1.

2.A.4 HYBRID SYSTEM

A third alternative is to implement a mixed multiple satellite system consisting of 12 GHz spot beam and broad beam satellites. This would give the capability of access to large numbers of channels (with broad beam) and the potential of home access to the SES with the low cost Japanese receiver.

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*This is also implicit in the design of the Canadian Anik broad beam system.

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SECTION 3

THE LEGISLATIVE AND LEGAL RESEARCH AREA

3.1 INTRODUCTION

The uses of a telecommunications system for education purposes are bound by legal constraints: Laws in many states specify required courses; in some states, textbooks used in required courses must be on a state-approved list; computer assisted instruction requires licensing of each school having transmission capability; copyright laws prohibit the use of commercially developed materials without the payment of royalties. Some of these constraints may be altered through legislative initiative, but as the history of pending copyright legislation shows, change in this area can be extraordinarily slow in coming. Nevertheless, the opportunities for education which satellite systems can offer cannot be arrayed independently of consideration of present laws or reasonable strategies for altering them.

Communications satellites make it possible to use regional or national telecommunications systems to distribute course materials or courses to local schools and elsewhere. New legislation and guidelines governing telecommunications will be needed to control the new technology. The needs of the educational community must be clearly represented if the full potential of telecommunications for education is to be realized and if social and educational interest are to be protected as private enterprise explores the economic potential of the new technology. Education must act now if it is to keep its foot in the door, but that action must be informed by both a sense of the educational priorities and by an understanding of the legal framework required to make those priorities realizeable.

3.2 STATE LAWS AND REGULATIONS GOVERNING PUBLIC SCHOOL INSTRUCTION

3.2.1 Introduction

Education has been viewed as a residual power of the states through interpretation of the Tenth Amendment and case law. Currently, there appears to be a trend toward an increasing leadership role at the state level. Thirty states have developed accountability programs designed to ensure the "adequacy and efficiency" of elementary and secondary schooling. And despite the U.S. Supreme Court's Rodriguez decision, the issue of school finance reform to be initiated at the state level is by no means dead. Within the range of state regulatory powers are actions to improve the scope and quality of education through regulations concerning curriculum standards and curriculum development, textbook selection, and school finance.

Some state constitutions are more restrictive than others regarding education. Thirty-eight states expressly enumerate an assortment of subjects for instructional programs in schools, while twelve do not specify courses of instruction. There is wide variation among states in the kinds of regulations enacted. In addition to constitutional mandates and statutes, more and more states are preparing policy statements or guidelines for assistance in meeting various educational responsibilities not explicitly spelled out in laws or mandatory regulations. (Previously, most legislatures have delegated duties without explicit procedures.)

State laws and regulations offer constraints for regionally- or nationally-based ETV systems. In order to understand these constraints, the following studies will be developed during Phase III:

A. Review state regulatory actions concerning (a) curriculum standards and curriculum development, (b) textbook selection and aid, and (c) school finance. This study should include regulations promulgated in (a) state constitutions, (b) statutes, and (c) policy statements or guidelines.

Questions

1. What legislative changes are necessary to give schools needed flexibility to use telecommunications systems?

2. The history of educational reform has demonstrated the importance of flexible legislation when a reform movement is in its early stages; otherwise programs can be hamstrung by legislative requirements. Michigan, for example, mandated an accountability program which says that every child in the 4th and 7th grades must be tested in math and reading. This has proved to be very expensive and has possibly had negative side effects in terms of forcing focus on a very narrow indicator of the quality of schooling. What recommendations can be made for securing the most flexible legislation possible in the area of telecommunications?

3. Software producers could respond to varying state requirements in a number of ways:

    a. They could concentrate on certain core courses mandated by many states. Forty-three states, for example, require courses on the ill effects on alcohol and narcotics and twenty-eight states require courses on the U.S. Constitution. If software producers wish to provide the basic materials for such courses, they would have to negotiate with state departments of education or state textbook commissions in roughly half the states and with local districts in the other half. In order to avoid negotiation problems, publishers could decide to provide only supplementary materials.

(1) Can regional organizations solve the negotiation problem? Will the states only be willing to allow regional organizations to provide supplementary materials, not basic materials?

(2) Will the market for supplementary materials be large enough to stimulate commerical software producers to develop them?

(3) Experience with the development of standard textbooks has shown that powerful states with many legislated requirements can force deletions and additions in textbooks which will be used in other states as well. Is it likely that regional software production will result in "bland" materials through an attempt to meet the requirements of a number of states?

b. Software producers could choose to provide only enrichment materials.

(1) Will the market for enrichment materials be large enough to stimulate commerical software producers to develop them?

(2) Should the federal government support the production of such materials for a trial period?

(3) Will the use of communciations satellites tc provide only enrichment materials be an expensive overlay on an already expensive educational system?

(4) Since it seems unlikely that all classes in a large regional area would be ready to use enrichment materials at exactly the same time, video recorders would be needed to record and store material for future use and re-use. Will such recording be permitted under existing copyright laws?

4. Serious challenges to the way American history was presented in the nation's schools began with the civil rights movement and has led to dramatic changes in social studies textbooks. But the new emphasis on current events and the problems of America has led to a counterreaction among some parents who view America's history as the story of heros and heroines. What effect will conflicting aims of state departments of education, local school boards, and national constituencies have on software developers? How can these conflicts be resolved?

5. In some states matching funds given by the stae to local districts must be used for the education of children who reside within that school district. When local districts cooperatively engage in satellite projects, state funds

could be lost. Some RESAs in the Appalachian project have encountered this problem and have been forced to use elaborate bookkeeping procedures to comply with state laws in order to avoid loss of funds. What state laws and regulations may constrain the shared fiscal arrangements necessary for using satellite systems?

B. Develop a history of the legislative/legal relationships between the Federation and the member states and the ARC and its member states.

Questions

1. How were these regional organizations able to overcome problems arising from varying state requirements concerning curriculum instructional materials and educational objectives?

2. Could the policies developed in (1) be used if ETV were used in core courses?

3. What conclusions can be drawn about the utility of regional organizations in solving the problem of coordinating various state departments of education?

4. What guidelines can be developed for the establishment of such regional organizations, if these organizations are found desirable?

C. Study state accountability programs for possible connections with telecommunications programs.

During the past five years, at least thirty states have developed programs broadly categorized as "accountability programs" and about twenty states have enacted legislation mandating various types of state-level activity to ensure the "adequacy and efficiently" of elementary and secondary schooling. In general, accountability action introduces new structures and procedures for decision-making. Colorado legislation can be considered proto-typical of one pattern. It requires:

1. A procedure for the continuous examination and improvement of the goals of education.

2. An assessment program to evaluate learner needs which includes basic skills, social sciences as well as attitudes to school and to citizenship, self-concept, and personal values.

3. Advisory committees at both state and local levels.

An alternate pattern, exemplified by Arizona, simply mandates the establishment of a continuous uniform evaluation system of pupil achievements in relation to measurable performance objectives in basic objects.

Questions

Accountability programs, whether legislated or not, address issues of the quality of education and they mark a significant development in the activities of state education agencies. Such activities would have direct bearing on any large scale use of satellite-televised instruction and they raise a number of questions.

1. What kinds of accountability activites are operative or contemplated in individual states? Specifically,

what state-level and local-level structures and processes relate to (a) the examination of goals and objectives, (b) testing/assessment of programs, and (c) public participation in decision-making.

2. What potential opportunities or constraints do such activites bring to the development of the educational uses of communications satellites?

3. What options exist for the kinds of relationships that could exist between these accountability activities and satellite education?

It can be assumed that satellite demonstrations require at least some minimal relationship to state policies. An examination of the experience of current demonstrations should provide information, for example, on potential advantages and disadvantages of (a) close coordination between the educational satellite and state accountability programs in planning and implemenation stages, and (b) ad-hoc, or occasional, relationships at strategic points in planning development.

D. To what extent can regional telecommunications systems provide a way of equalizing inputs to local schools? The issue of school finance reform is not dead despite the Rodriguez decision. In that decision the U.S. Supreme Court suggested that action on this issue should take place at the state level.

E. Examine the limitations on real-time use of the satellite accruing from state and local differences in such "mundane" matters as daily opening and closing hours, the school calendar (opening and closing dates, holidays, etc.).
Questions

To what extent do such scheduling differences force schools away from real-time use of the satellite?

3.3 FEDERAL LAWS AND REGULATIONS RELEVANT TO EDUCATION TELECOMMUNICATIONS SYSTEMS

3.3.1 Introduction

The ground rules for satellite communications in the United States are contained in the Communications Act of 1934 and in the Communications Satellite Act of 1962. Unfortunately, these rules are not always clear. The debates surrounding the growth of cable TV demonstrate the need for careful consideration of the role a new technology is to play in the nation's communication system and of the most appropriate means of regulating that new technology. For example, the present rules governing cable are based on the Communications Act of 1934 which was designed to deal with technologies having limited channel capacity. Whether or not it is appropriate to apply similar rules to cable with its abundance of channels has been questioned.

In addition to the complex regulations governing the transmission medium itself, there are regulations governing the content which is transmitted. Copyright laws are an important consideration here. The copyright problem has international as well as national dimensions. Both the Ad Hoc Committee on Copyright Law Revision in the United States and the UNESCO Committee of Governmental Experts on Problems in the Field of Copyright and of the Protection of Performer, Produces of Phonograms, and Broadcasting Organizations Raised by Transmission via Space Satellites have recommended that the educational community be allowed to make reasonable use of copyrighted materials without securing clearances or paying royalties. Without some new policy the cost savings made through use of a cheaper distribution system (e.g., the satellite) could be more than eliminated through the payment of royalties. If copying a program off the receiver by means of video recorders is regarded as infringement of copyright (as it could be under current law), schools might be unable to store programs for later use and reuse. Recording for delayed transmission, while technically a violation, is not likely to be prosecuted. Recording for storage and reuse presents a greater problem. Suppose, for example, that a broadcast course on art appreciation includes the presentation of a series of slides developed by a commercial software producer. By copying these programs, a local school would in effect be receiving the continued use of the slide series without having to buy it from the producer. Obviously, if the software producer is going to have any incentive to develop such material in the future, his interest must be protected in some fashion. New fee/royalty schedules might be one possibility. Some compromise must be effected to insure the continued production of new materials, and the maximum usefulness of the telecommunications delivery system. Unless some compromise can be achieved between the interests of commercial developers of materials and the interests of the educational system, the cost savings accruing from the new mode of delivery could be eliminated by the payment of royalties, and the flexibility of the system could be severely hampered.

The present copyright law was enacted in 1909 before the widespread development of mass communications. Recent attempts to revise the copyright law have met with failure. In the absence of clear legislative guidelines, the courts have been called upon to adjudicate disputes concerning technologies not in existence when the present law was framed. One of the principles most consistently used by the court concerns the extent to which the alleged copyright infringement cuts into the market of the copyright owner. Recently, however, the Supreme Court, in the majority opinon in CBS vs. Telepromoter, served notice to Congress that the regulation of the relationship between the broadcast industry and CATV could not be controlled by litigation and must be left to Congress.

A variety of proposals have been made concerning who may operate domestic communications satellites and for what purpose. But what is needed is a broad policy for integrating communications satellites into the communications system of the United States. The legislative and regulatory thicket surrounding the telecommunications issue is formidable. Fortunately, many groups are working on these problems. The NEA, for example, is coordinating the work of an Ad Hoc Committee of Copyright Law Revision whose members are drawn from 43 educational organizations. The Educational Materials Producers Council has a Copyright Committee. The Association for Educational Communication and Technology has recently adopted a resolution on copyright. The Corporation for Public Broadcasting, the National Association of Broadcasters, and the National Cable Television Association are examples of other groups who have interests in this area. A coordinating agency is needed to synthesize the work of such groups and develop a plan for adequately representing the interest of the educational community in the drafting of new legislation and regulations governing communications satellites.

In order to understand the constraints which present and future legislation and regulations present for an educational telecommunications system, the following studies would be developed during Phase III:

A. Review present laws, guidelines, court decisions and FCC regulations which govern the educational use of telecommunications systems.

Questions

1. What legislative/legal constraints are currently placed on the use of communications satellites for educational purposes?

2. What limitations on using the interactive capacity of the satellite arise from FCC licensing requirements for broadcast transmitters? Would every school having transmission capability have to be licensed?

3. What constraints do FCC signal quality regulations place on the number of channels which a satellite delivery system can provide? Could those requirements be weakened for educational users?

4. In what new areas is legislation required to make it possible to provide new or improved services via satellite?

B. Survey the history of the ESCD for opportunities or constraints which arose from federal laws or regulations govering telecommunications.

Questions

1. How were any problems which arose solved?
2. Could similar solutions be used in other situations?
3. What legislative changes would have facilitated the ESCD effort?

C. Convene task forces of those who have an interest in (a) new FCC regulations governing domestic communications satellites, and (b) new copyright legislation. Individuals who might be contacted include representatives of:

1. The Citizens Communications Center (CCC)
2. National Association of Broadcasters
3. National Cable Television Association
4. Williams & Wilkins Company
5. Copyright Committee of the Educational Materials Producers Council of the National Audio-Visual Association
6. The Telecommunications Specialist of the NEA
7. Legal specialists on communications law and space law, (e.g., the Entertainment Law Institute of the Law Center of the University of Southern California)

Questions

1. Because satellite transmissions cannot be contained within precisely defined boundaries, it is quite possible that programs beamed to certain parts of the United States would "spillover" into Canada or Mexico. (a) Would such transmissions be governed by international regulations? (b) What restrictions would such regulations impose?

2. In 1971, the International Telecommunications Union, a United Nations agency, held a World Administrative Radio Conference on Space Telecommunications which allocated frequencies for direct broadcast satellites but placed such signal strength limitations on the use of the UHF and 2500 MHz band that reception by unaugmented receivers is impossible. ITU regulations have the force of a treaty among member nations. Another allocation conference will be held by WARC-ST in 1977. What effect will signal strength limitations made as part of international agreements have on the United States' ability to direct broadcast satellites for domestic purposes? Will the costs of augmenting receivers (such augmentation will be required because of weak signal strength from the satellite) effectively preclude direct-to-home broadcasts?

SECTION 4

ORGANIZATIONAL RESEARCH AREA

4.1 THE ESCD STUDY

4.1.1 Rationale

In our initial response to the RFP, the EPRC stated:

> Crucial impacts of the ESCD projects on social relations and institutions can be described in terms of the changed ways in which the various actors and stakeholders...have access to, participate in, have control of, and in other ways influence the development and operation of new and existing social organizations.

Further study and reflection has strengthened our belief that the most appropriate focus for our study of the demonstration project is a description of who has access to, participates in, and has control of various aspects of the organizations associated with the ESCD. (See Figure 4.1.)

Our investigation of the demonstrations, then, will concentrate on the issue of organization and organizational structure and will stress the relationships between different participating organizations. There are several reasons why this is a worthwhile approach:

A. Characteristics of a Federal Role: It is our understanding that policy research is oriented to decision-making and is only worthwhile when it operates within the parameters of the decision-making. Policy analysis for federal decision-makers must relate to federal policy options, roles, and leverage. One means of federal action is through legislation. Usually legislation specifies which organizations can participate in specific projects and the extent of their participation by indicating who is eligible for funding and to what extent. Often the impact of federal programs is

(1) WHAT KINDS OF - existing (modified or new) INSTITUTIONAL ARRANGEMENTS ALLIED WITH
- possible

(2) WHAT KINDS OF TELECOMMUNICATIONS/SATELLITE SERVICES

(3) CAN ENCOURAGE:

- citizens
- parents
- teachers
- students
- administrators
- opinion leaders
- state officials
- regional officials
- federal officials

TO HAVE:

- access to
- participation in
- control of

THE:

- goal setting
- planning
- operating
- evaluating
- utilization

OF PROGRAMS AT VARIOUS:

- state
- regional
- local
- school
- family
- individual

LEVELS

(4) IN WHAT MANNER

(5) TO WHAT:

- different
- same
- more diverse
- uniform

- educational
- political
- communal
- cultural
- commercial
- professional

ENDS OR GOALS?

Figure 4.1. Framework for Viewing the Three Demonstrations with a Particular Focus on Organizational/Institutional Issues

not directly upon the client groups themselves, but rather upon intermediate organizations. These organizations may interface directly with the ultimate clients or they may interact with still other organizations until ultimately the clients are affected. In the ESCD, for example, federal actions have directly affected regional and state organizations and have indirectly affected junior high school students in the Rocky Mountains, teachers in Appalachia, and pre-school children in Alaska.

Two important questions are: Which organizations are the most appropriate foci for federal impacts?; and In what ways should such federal interventions occur? Organizations created even for temporary purposes tend to form expectations and to act in order to ensure their own continued existence. In the ESCD, if no satellite replaces the ATS-F when it is moved to serve India, one of the most important residual effects of the ESCD may be the new organizations which have been formed and the changes which have occurred in existing organizations because of the satellite project. For example, we suspect that an important side-effect of the ESCD will be the strengthening of regional organizations. Even now, pressure from the demonstration regions to launch a replacement for ATS-F is an indication of this new regional activity. It will be important to explore the potential importance of this side-effect. The choice of organizations which will be directly affected by federal actions may have an important impact on the project outcomes. It seems likely that acting through universities, for example, might well have very different consequences from acting through local political organizations.

B. Generalizeability: We believe that the demonstration project will act as a catalytic agent to encourage the development of new organizational structures and to strengthen or alter existing ones. The satellite and its accompanying technology will pose particular problems and offer particular opportunities to the human beings who try to organize themselves for their use. We would expect these problems and opportunities to be reflected in the subtle and not so subtle changes that take place in the organizations comprising and affiliated with the ESCD. For example, the satellite costs more money than a school district or even a state can afford. The size of the footprint goes beyond state boundaries. The use of regional organizations to manage satellite projects can be seen as a response to those features of the technology.

Thus we can learn something about the organizational structures required to make good use of telecommunications technology from the experience of the various participants in the ESCD. The problems and opportunities they will encounter in trying to set goals, plan, operate, evaluate, and utilize the satellite services are likely to be encountered by others in similar circumstances.

C. Experimental Context: The three demonstration regions manifest appreciable organizational differences. There are also differences in relationships at different levels within each region, although these are not as interesting as comparisons between the three regions. Thus the ESCD provides an experimental context which will allow us to examine the consequences of these differences as they influence selected processes and outcomes. This experimental context was not, for the most part, an intentional one; i.e., it was not a part of the demonstration goals. Nevertheless, it is an excellent opportunity for federal decision-makers to examine the significance of impacts of different organizational structures.

4.1.2 Overview: Our Approach to Organizational Structures

For the purposes of this investigation, an "organization structure" is understood to mean the network of relationships in a social-political system. A model of such an organizational structure would be a "map" describing what the system does (both internally and externally with respect to other interacting systems) in terms of:

a. the flow of various kinds of information,
b. the allocation movement, and consumption of resources, and

c. the distribution of decision-making power (including its exercise) among the persons and components of the system.

An organizational structure can be represented by a diagram illustrating the major functions of the organization and the manner in which these functions are interrelated. An elementary diagram of a dynamic organizational structure would portray (a) a set of activities or operations, (b) that act upon a set of inputs, (c) to produce a set of outcomes. In addition, these activites are monitored and moderated by a set of management functions which compare the observed conditions (both inputs and outcomes) with its values, goals and objectives. These management functions also include the ability to allocate resources (money, time, talent, materials, etc.) within its limitations according to plan, in order to achieve desired changes in the observed conditions. Finally, the management functions include the assessment and evaluation of its efforts to achieve the desired effects. (For further elaboration, see Appendix 4.A.)

An organizational structure may be described as more or less "open" according to the degree to which it exchanges (either gives or receives) information, resources, or power with other organizational units. A "closed" structure is one which neither gives to nor receives from its environment. Conversely, an "open" system freely exchanges information, resources, and power with its environment. Most social-political systems lie between these two extremes: they could not continue to exist as totally closed systems, nor would they have independent status if they were totally open. Thus, the terms "power" and "authority" suggest the independence or partial-closedness of an organizational structure, while the terms "responsiveness" and "accountability" suggest an interchange taking place across organizational boundaries, as in a partially open system.

Most social-political organizations exist in an environment that fosters a relatively enduring balance of openness and closedness with respect to all three factors identified above as being critical indicators of an organization's exchanges with its neighbors: information, resources, and power. The present study proposes to examine carefully the degree to which the many agencies and organizations that are cooperating within the ATS-F project are actually exchanging information, resources, and power. Of particular importance to the policy analysis which is the core of this investigation, is the proposal to analyze the forces and factors that influence the relative openness and closedness of the agencies within the ESCD supra-system.

In order to provide the best basis for estimating the impact of various policies established at different levels in this complex system, we propose to examine closely (a) the range and types of decisions that are made in each organizational sub-system, (b) the types of information considered in reaching each of the various decisions, and (c) the outcomes of these decisions in terms of the allocation of resources and recognition of limitations. For example, a low-level policy may furnish the director and cameraman in the TV studio with the scripts of the educational programs and leave the details of shooting and editing up to them. In other projects, this particular policy has resulted in major shifts in the content of the programmed materials as the director imposed his artistic value structures on the materials and significantly distorted the original educational intentions of the program.

Similarly, it may have been the intention of a regional organization to involve local persons heavily in the selection of content materials for the programs to be produced, but budget decisions precluded the presence of any local persons during the time that needs analyses were being transformed into curriculum decisions. In both of these examples, decisions were made about the allocation of resources and power on the basis of significant limitations in information. As the factors influencing decision-making within each of the three regional projects are understood (along with historical data on similar projects), it will be possible to make certain predictions about the probable outcomes of different policies concerning the establishment of telecommunication networks intended to enhance the social, cultural, and educational dimensions of large regions of the country. It is these factors of organizational structure which form the focus of our investigation of the demonstrations.

Specifically, we expect such an examination of the demonstration project to indicate (a) which organizational structures are most likely to encourage utilization of the satellite and its related services, and (b) which organizational structures are most likely to be responsive to the expressed needs of the client groups and to opportunities for worthwhile innovation and change.

Utilization is a further specification of participation: Do those who have access to information, resources, and power take advantage of these opportunities? We are well aware that access does not in itself guarantee participation. The utilization problem is a persistent one with respect to technology as school closets full of unused equipment show. It is particularly tempting with respect to telecommunications to conflate "providing citizens with access to information" with "informing the public." The government printing office has produced huge numbers of useful booklets on health care. Would providing the same information by means of telecommunications be more likely to result in an informed public than making those printed booklets available? We are proposing a utilization investigation described in Part A, Section 5 of this document. The data gathered concerning the utilization of the technology of the ESCD will be part of the first area of study of that investigation--"current utilization of various technologies for educational purposes."

Typical Questions:

(1) How did the organizational structures of the ESCD encourage or constrain utilization of satellite services? For example, how helpful do teachers and others find the work of the state coordinators?

(2) Which organizational structures provide what opportunities or constraints for utilization of telecommunications services?

The responsiveness of an organization to various individuals or groups is an indicator of access and participation as well as control. Responsiveness concerns the reaction, or lack of reaction, of organizational structures to changing stimuli. Such stimuli include the changing needs and interests of those whom the system serves, crisis events, and situations which provide new opportunities for innovation.

The satellite and related telecommunications delivery systems may lead to greater centralization of fiscal responsibility and therefore of the decision-making process. There is always the danger in a large hierarchical structure that the programs initiated by those at the highest levels will be out of phase with what those who are to be served by those programs see as their needs. Needs assessments are one response to this problem. Another response is the encouragement of the development of organizational structures which involve the client groups in the decision-making processes, so that feedback and suggestions flow quickly between the clients and those who make the ultimate decisions.

Typical Questions:

(1) How responsive were the organizational structures of the ESCD to client needs and interests: Were some organizational structures more responsive than others? (For example, the RESA's working with the ARC are organizations which maintain grass-roots connections with the local level and those served by their programs through the local school districts and, at the same time, have connections to the regional network of the ARC. How responsive are the RESA's to stated client interests and needs?)

(2) What features of the technology provide what opportunities and constraints for encouraging organizational responsiveness to client needs and interests?

(3) What organizational structures create the optimum balance between centralization and decentralization of the decision-making processes?

Organizational responsiveness also concerns the ability of an organization to respond to crisis or to new opportunities for innovation and experimentation. One response to crises and new opportunities is to create new organizations to handle new programs, thus bypassing old institutions. Ultimately, this can result in an expensive, top-heavy bureaucracy. An alternative would be to modify existing organizational structures so that they become more flexible.

Typical Questions:

(1) How did the organizational structures of the ESCD respond to crises and new opportunities?

(2) What special features of telecommunications technology provide what opportunities or constraints for encouraging organizational responsiveness to crises and new opportunities? (Real-time programming, for example, may encourage responsiveness to new opportunities for innovation while "canned" video-tape libraries may constrain responsiveness. Also, in this connection, it will be important to consider the interactive features of the technology and their potential contributions to responsiveness.)

Summary: We intend to analyze the organizational structures of the ESCD in terms of who has access to, participates in, and has control of (a) the flow of information, (b) the allocation, movement, and consumption of resources, and (c) the distribution of decision-making power. Key concepts for our analysis include the degree of openness of the system, the responsiveness of the system to people and events, and the extent to which the system encourages or discourages utilization of telecommunications technology.

4.1.3 Research Question Areas

The following eight question areas provide the focus for our investigation of the Appalachian, Rocky Mountain and Alaskan demonstrations. As described above, the investigation of the demonstration will concentrate on the issue of organization and organizational structure, together with the relationships between different participating organizations. Where appropriate, the study will examine organizations at the federal, regional, state, intermediate, and target community levels.

1) Preexisting Organizations

What existing organizational structures were available to receive the ESCD?

> In what manner did preexisting organizations participate in various aspects of the ESCD?
>
> Who had access to, and participated in, the goal setting, planning, operating, evaluating, and utilizing of various programs and services?
>
> How did the various organizational participants influence the ways in which the various programs were conceptualized, delivered, and utilized?

2) Organizational Change and Development

What changes could be observed in the pre-existing organizations as a function of their participation in the ESCD?

> What range of new organizations developed as a consequence of the ESCD?

How did these changes come about? Were they "planned" or merely "discovered" to have occurred after the fact?

What kinds of situations or interventions precipitated those organizational changes or developments?

3) Consequences of Organizational Changes

What were the observable consequences of organizational change and/or organizational development?

Were the changes viewed by all as good or bad? If there was no agreement, how can the differing perceptions be best understood?

Where these organizational changes likely to last longer than the duration of the ESCD? Would it be desirable for the changed or new organizations to persist, disappear, or be modified?

How self-sufficient do the organizations appear to be? Do they appear to be autonomous?

4) Strengths and Weaknesses of Various Organizations

Who attributes what strengths and weaknesses to the organizations of the ESCD?

How are the strengths and weaknesses of the various participating organizations perceived by various participants and observers?

Is there a consensus on organizational strengths and weaknesses?

In what ways did the ESCD minimize or maximize those strengths and weaknesses?

5) Services Best Supplied by Various Organizations

Given the present organizational structure, what particular services were best offered?

Is there agreement as to the type and range of services which were effectively supplied during the ESCD and those which were not?

Were the organizational participants more suited for involvement in the delivery of certain services rather than others? Was this for idiosyncratic reasons, or were there certain organizational predispositions?

6) Significance of Organizational Structure

Which of those events that occurred--and those which were expected to occur but did not--can be interpreted as a function of organizational structure?

How much of the ESCD can be understood in terms of the success and failure of particular organizations?

Can the successes be repeated? If so, what key organizational factors would help or hinder?

Are the failures avoidable? If so, what key organizational factors would help or hinder?

7) Organizational Structures for Responsiveness and Utilization

Based on an examination of selected sites, what kinds of organizational structures appear to be most effective for increasing responsiveness and utilization?

Are there characteristics of organizations which make them more or less responsive to unexpected situations? What parts or functions of organizations can encourage or discourage adaptation to unforeseen circumstances?

In a parallel sense, what were the characteristics of organizations which were most successful in reaching potential clients and having services utilized?

8) Alternative Organizational Forms

What alternative organizational structures, or modifications in existing ones, appear to be required if a satellite telecommunications system is to be implemented?

> What alternative organizational forms are most appropriate for the delivery of telecommunication-based services? Under what circumstances?
>
> To what extent can existing or modified organizations take advantage of what range of telecommunication-based services?
>
> If the development of new organizations is considered essential, what can be learned about this problem from the ESCD?

4.1.4 Method

A. A Model For Description of the ESCD

A team of social scientists involved in assessing the social action programs marking the last decade stated: "the issue is not the simple-minded one of 'Does It Work?' but the more important one of 'When such a program (event or intervention) is introduced, what then happens?'"[1] And Carol Weiss remarked that, "as a matter of record, relatively few evaluation studies have had a noticeable effect on the making and remaking of public policy." Later, she comments: "perhaps one of the reasons that evaluations are so readily disregarded is that they address only official goals."[2] There is indeed a difference between "official" goals and other outcomes; hence, the need to search for logical and empirical relationships: What was intended? What actually did occur? In operationalizing our research questions into a descriptive matrix, three priorities emerged:

1) The importance of concentrating on actual activities inside each region,

2) A recognition of the varying requirements for information held by the important audiences, and

3) The importance of obtaining a wide spectrum of value perspectives.

Our conceptual framework for the examination is taken from the work of Robert Stake.[3] Stake argues convincingly for the importance of building meaningful descriptions so that people who were not present will have some reasonable basis for understanding what happened. In that respect, we intend to describe the site-based activity in terms of the organizational considerations listed earlier. More importantly, with this design we will build an empirical base that will help us locate the generalizeable aspects of the ESCD. (See Figure 4.2)

To develop this empirical base, we intend to array the intentions of the sites as suggested in their documentation and then compare these intentions with empirical observations of actual occurrences. This comparison searches for congruences between what was intended and what was observed. Furthermore, our descriptive effort will be sensitive to unintended occurrences and will seek to capture and array them. Our experience suggests that these unintended events are frequently as important, if not more important, than those that were planned.

Our portrayals of the sites in terms of their organizational structures will consider the antecedents (preconditions), transactions (processes and activities), and outcomes (effects) and their relationships to each other. We will ask, for example, "Given condition (A) and the activity set of transaction (T), is it reasonable to expect the intended outcome (O)? This is the question of logical contingency. Examined empirically, the field-based indicators of actual A's, T's, and O's, intended and unintended, will be analyzed for contingent relationships to each other as well as for congruence with what was intended. (See Figure 4.3.)

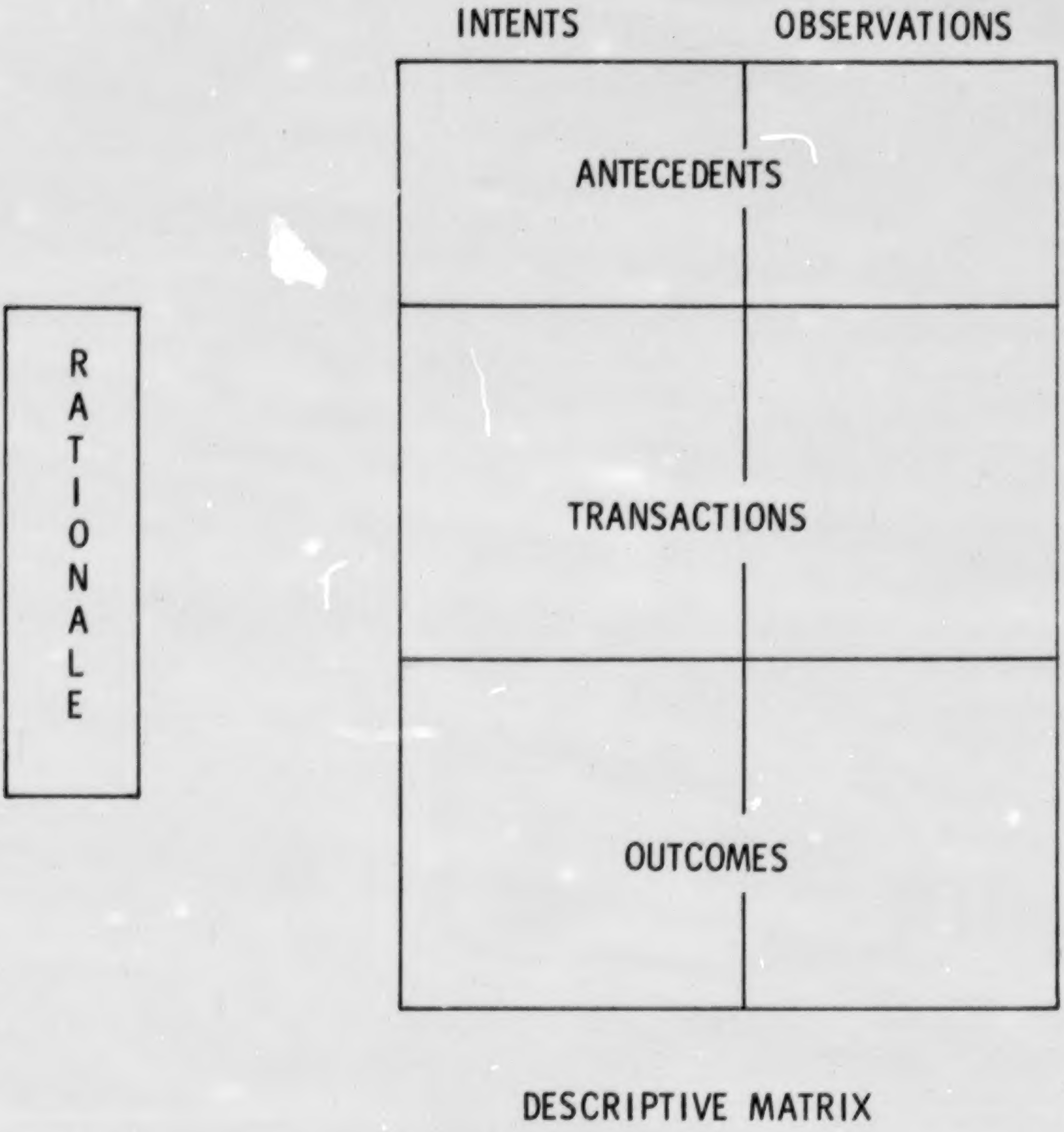
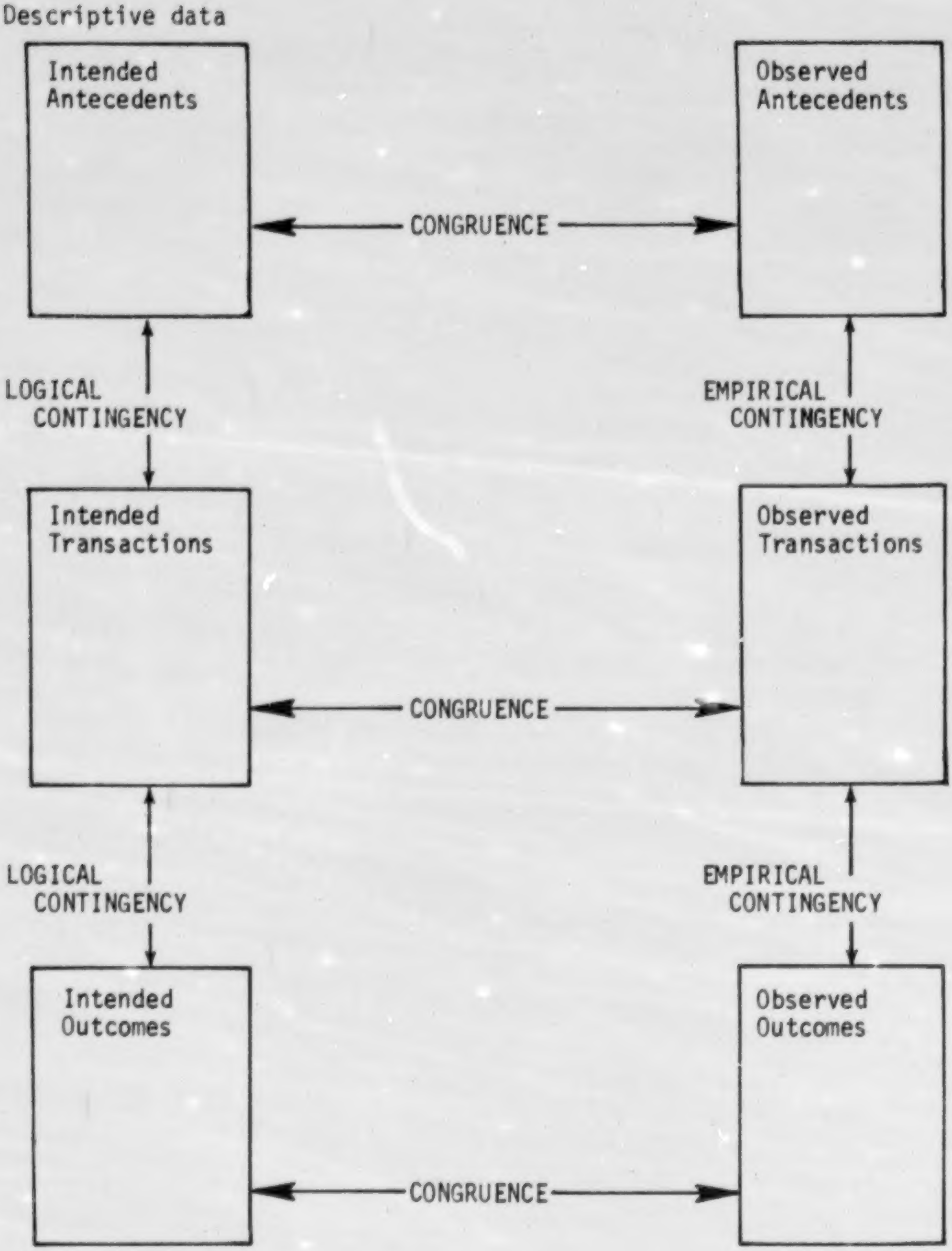

INTENTS
OBSERVATIONS
RATIONALE
ANTECEDENTS
TRANSACTIONS
OUTCOMES
DESCRIPTIVE MATRIX

Figure 4.2. Basic Design for Building the Site-based Descriptions


Descriptive data
Intended Antecedents
Observed Antecedents
CONGRUENCE
LOGICAL CONTINGENCY
EMPIRICAL CONTINGENCY
Intended Transactions
Observed Transactions
CONGRUENCE
LOGICAL CONTINGENCY
EMPIRICAL CONTINGENCY
Intended Outcomes
Observed Outcomes
CONGRUENCE

gure 4.3 Basic Design for the Examination of Logical and Empirical Relationships.

Our efforts inside the demonstration sites, as stated above, concentrate energies and resources on the theme of organizational structures and are responsive to the specific character of the ESCD project. For example, two of the intentions underlying the overall ESCD project could be paraphrased thus:

1) The development of local communities through educational services designed to reduce limitations in remote communities due to physical and social isolation from the potential richness of U.S. culture in general, and

2) The enhancement of the unique features of local cultures through programs which will build on and give status to traditional patterns of individual and community life.

Given these two basic intentions, it is essential to develop a deep understanding of the local interconnections among social and psychological facts and processes. How do these two, potentially conflicting intentions actually work out, as perceived by persons, families, and groups in the local communities?

While it is possible to get insight into this question from talking with persons associated with the local communities, those responsible for gathering analyzing, and interpreting information on the "meaning" of this project to the local communities will need an understanding of the perceptions, values, and patterns of life in that community in order to be able to interpret those responses. Therefore, we have selected one community from within each of the three regions for an extended visit by one of our field staff to conduct an in-depth community study. (The nature of these studies will be explained in depth later.) We plan to use the community study methods as developed and described by Arensberg and Kimball in Culture and Cummunity[4] to obtain information and insights on the organizational issues to be examined in this study.

B. Methods Of Data Collection

The EPRC's activities in the field will rely on patterned interviews, on participant-observation, and the use of unobtrusive measures. At this time we do not plan to use questionnaries. Their validity--when used across occupational lines, social class divisions, and educational attainment levels--has been challenged time and again. Furthermore, we see them as intruding into the lives of residents affected by ESCD and into the procedures already fashioned by on-site evaluators who have constructued--and are using--questionaries.

Many have observed that participant-observation is particularly useful for program planning and improvement. Recently Glaser and Backer appraised the strengths and weaknesses of participant-observation.[5]

POSITIVE FEATURES

1. Data are collected by direct contact with real life situations and by observing behaviors as they naturally occur.
2. On-site observation permits input of a richness and detail that seldom can be achieved through any secondary source such as test instruments.
3. As a rule, participant-observation may be most efficient...when combined with case studies, pre- and post-test studies, analysis of statistical data, document analysis, and some interviewing of persons whom the participant-observer could not observe directly.

NEGATIVE FEATURES

1. Because the data gathered are the perceptions and reactions of individual observers..., quantification and manageable summary may be very difficult.

2. Time restrictions may put evaluators in the uncomfortable position of having to decide between observing many program activities somewhat superficially or concentrating on a few phases in great depth, but losing the comprehensive picture of the whole program.

We believe that our data collection strategy will allow us to capitalize on the strengths of participant observation, while minimizing the negative features. (1) We are treating the demonstration sites as parts of a wide spectrum of study. We will seek data from a variety of sources. (2) Our overall design incorporates vertical and horizontal samplings which will help us to formulate a comprehensive picture. We intend to examine a select number of settings inside the demonstration regions; but these, in turn, are linked across settings by use of common instruments and a high level of communication inside the EPRC unit, and are connected in vertical fashion to other agenices, organizations, and individuals within the respective demonstration sites. Interview protocols can be found in Appendix 4.B.

A variety of techniques can be used in conjunction with participant observation. Some of those which we will be using include unobtrusive measures, check lists, and interim summaries.

The activity of measuring frequently affects and often changes the very thing it measures. We will attempt where possible, in this study, to be sensitive to unobtrusive indicators that will flesh out our descriptions and also support our interpretations of site-based activity. The number and titles of books in a person's library, for example, could be considered an unobtrusive indicator of that person's reading interests.

Checklists are useful devices for systematizing a collection of observations. This technique involves the use of a pre-formulated list of characteristics which are "checked off" as either present or absent by the observer.

The technique interim-summary involves the medial and proximate reporting of information so that it can be properly coded and processed. Site observations of the order of magnitude proposed here usually generate large amounts of data. Consequently, we anticipate that interim summaries of data collected on-site will be necessary to speed the efficient processing of information. The interim summaries will be forwarded to the information coordinator for analysis.

4.1.5 Sources of Data

A. The Demonstration Regions: A 5-tiered System

A.1 Introduction

For the present study, sources of data are understood to refer to any resource, human or material, that can provide useful information relative to one or more of the eight question areas under investigation. The graphic representation in Figure 4.4 of the organizations involved in the many aspects of the ESCD project has been useful in identifying potential sources of data on the policy questions to be explored. (In addition, the "systems model" developed in Appendix A has further explored certain characteristics of this interconnected network of agencies as an aid in the development of instruments.)

As shown in Figure 4.4, the overall project has been represented by a "5-tiered" diagram, relating organizations at the federal, regional, state, inter-mediate and local community levels. The primary agency linking all of these agencies at the federal level is the National Institute of Education (NIE); yet NIE has close connections with other federal agencies interested in or involved with this ESCD project, such as NASA, USOE, and others.

At the regional level of this 5-tiered system, two multi-state organizations have merged to plan and conduct activities that serve large geographi-

ESCD PROJECT

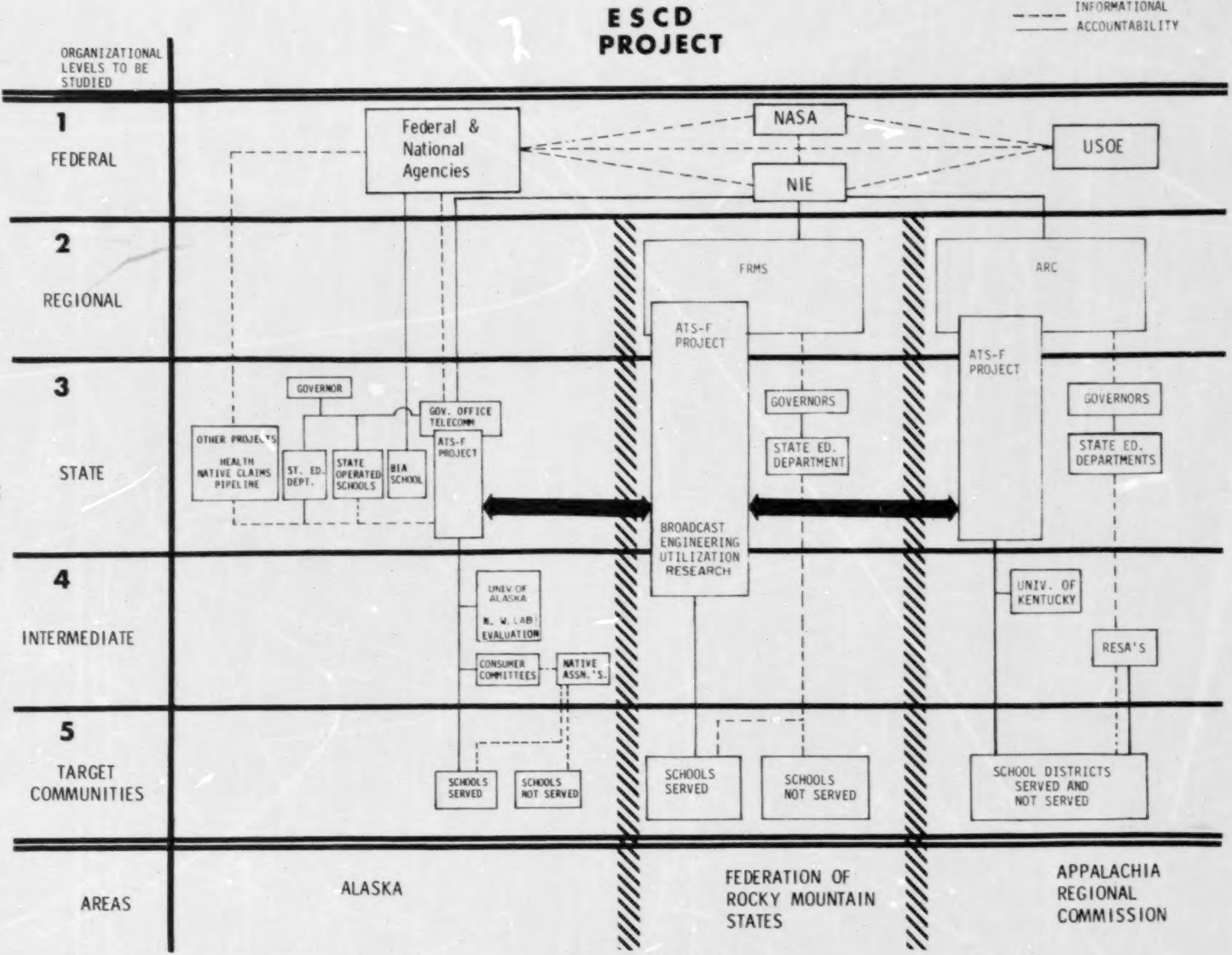

INFORMATIONAL
ACCOUNTABILITY
ORGANIZATIONAL LEVELS TO BE STUDIED
1 FEDERAL
2 REGIONAL
3 STATE
4 INTERMEDIATE
5 TARGET COMMUNITIES
AREAS
Federal & National Agencies
NASA
NIE
USOE
FRMS
ARC
OTHER PROJECTS HEALTH NATIVE CLAIMS PIPELINE
GOVERNOR
ST. ED. DEPT.
STATE OPERATED SCHOOLS
BIA SCHOOL
GOV. OFFICE TELECOMM
ATS-F PROJECT
ATS-F PROJECT
BROADCAST ENGINEERING UTILIZATION RESEARCH
GOVERNORS
STATE ED. DEPARTMENT
ATS-F PROJECT
GOVERNORS
STATE ED. DEPARTMENTS
UNIV OF ALASKA
N. W. LAB EVALUATION
CONSUMER COMMITTEES
NATIVE ASSN.'S.
UNIV. OF KENTUCKY
RESA'S
SCHOOLS SERVED
SCHOOLS NOT SERVED
SCHOOLS SERVED
SCHOOLS NOT SERVED
SCHOOL DISTRICTS SERVED AND NOT SERVED
ALASKA
FEDERATION OF ROCKY MOUNTAIN STATES
APPALACHIA REGIONAL COMMISSION

Figure 4.4

cal areas crossing the boundaries of individual states: the Appalachian Regional Commission (ARC), and the Federation of Rocky Mountain Stations (FRMS). Each of these organizations is responsive to the governors of the states served and conducts a number of regional projects.

At the state level, in Figure 4.4, are the Alaskan ESCD project, the governors supporting the project activities, the State Education Departments (SED's), and other state projects which are involved in, or operating in parallel with, the ESCD activities.

At the intermediate level in Figure 4.4, are the agencies which work with the state and regional agencies in preparing for, distributing, and evaluating the educational materials and services.

Finally, at the "target community" level there are districts, communities, and schools which are the intended audiences for the services provided through the overall ESCD project.

Several data collection techniques and modes of analysis will be employed in tracing the antecedent conditions, the developmental transactions among the agencies, and the organizational outcomes within this 5-tiered system of agencies. As is suggested by the form of Figure 4.4, organizations and activities shown in the diagram may be examined both horizontally (at a particular level, across the three regional projects), or vertically (within a particular regional project, through the five "tiers" of organizations). In these ways, alternative comparisons and contrasts can be made, and individual organizations can be understood within this hierarchical structure of other agencies above, below, and in parallel with it. At many points throughout this complex network, the sources of data will include leaders and key spokesmen for communities and agencies, selected citizens and participants, documents and reports that circulate among agencies, and the public media.

Although the ESCD allows for the examination of many organizational structures and relationships within this complex network, we presently intend that only selected ones will be directly investigated. Our selection of data sources from this network, has been based on two broad considerations:

1. The representativeness of particular data sources through this 5-tiered network, and
2. The ease of access to the on-site activities and data sources, given our knowledge of the local and regional dynamics and the assistance of persons within the three regional projects.

In addition, we are aware that emerging issues of both a social and a political nature, as well as technological considerations, require that the specific sources of data indicated here must be regarded as tentative. Final decisions on the sites selected for data gathering will be made in concert with the regional project directors and their staffs and the NIE Project Officer. In addition, latitude must be provided for such changes in plans as may be required to observe the effects of emerging issues pertinent to our investigation of what we expect to be a dynamic organizational structure.

In spite of the tentativeness of the following plans, we have identified a number of agencies and communities within each of the three regional projects as sources of data which will inform the policy issues which are central to this study.

A.2 The Alaskan ATS-F/HET Experiment

The primary sources of data on the Alaskan demonstration, looking vertically across the diagram of Figure 4.4, will include agencies at each of the levels shown (except that the equivalent to the other "regional consortiums" is, here, concerned wholly with events within the State of Alaska). Tentatively, the agencies and communities to be visited will include those listed below. At the same time, it is important to recognize that the "on-site" evaluator (not yet selected by the Project Director, at the time of this writing) will also be visiting and gathering data from these same sources, and that it will be critically important to coordiate all data gathering with the Project Director and the evaluator, working with and through NIE project officers as needed, to obtain the required information. Tentative sources of data include:

1. The Governor's Office of Telecommunication
2. The Alaskan ATS-F project; including its director and several members of the professional staff
3. Representatives of the different state-level school systems participating in or affected by the project, including the
    a. State Education Department
    b. State Operated Schools
    c. Bureau of Indian Affairs Schools
4. The agencies participating in developing, distributing, and evaluating the curriculum materials, including
    a. The Northwest Regional Laboratory of Anchorage and Portland, Oregon
    b. The University of Alaska TV station and associated facilities
    c. The independent evalutor who will provide both formative and summative evaluation information on the project. (Many of the activities proposed here will be conducted in close coordination with this person or agency, to prevent redundancy and to optimize the use of available resources.)
5. The committees and associations, or selected persons involved in those groups of native Alaskans who influence this ATS-F project, such as:
    a. The Consumer Committees that provide inputs and approval to the curricula and programs prepared for distribution through this project, and

    b. The Native Associations (e.g., the Tanana Chiefs Conference) representing the combined interest and concerns of groups of villages and the particular culture of native Alaskans.

6. Associated state and federal projects and agencies whose activities and interests closely parallel those of the ATS-F project, such as:
    a. The Public Health Service, which is cooperating in terms of the health and health-education aspects of this project, and maintains contact with the remote villages through the ATS-1 radio satellite, and
    b. Other state and federal groups involved in projects related to the cultures in the remote villages, such as:
        --the Native Claims Act
        --the Alaskan Pipeline

7. Local communities served by the ATS-F project, in order to visit and talk with school and community persons such as:
    a. Yukatat, a southeastern coastal village which has considerable contact with the dominant culture while still maintaining strong ties to native traditions,
    b. Aniak, a west-central village, and
    c. Allakaket, a north-central village, which will be visited more extensively.

Because of prior contacts and its isolated social and geographical location on the outer fringe of the ESCD broadcast area, the village of Allakaket has been tentatively selected for an extended "community study." In a previous NIE visit to Allakaket, very brief contacts made with members of the school board and conversations with the school teacher suggested an openness that could lead to fruitful contacts for this study.

The purpose of this extended contact with this one village would be to give the observer personal experiences which would provide an alternative basis for his subsequent synthesis of data from many Alaskan sources; not only could the observer synthesize on the basis of a professional-systems point of view, but also from a personal-experiential orientation. For this reason, the observer visiting this village would be a senior staff member with extensive experience in both "systems" and "personal" types of observation methods.

A.3 The Federation of Rocky Mountain States (FRMS)

In the demonstration region that spans eight states in the Rocky Mountain area, the primary sources of data will be agencies associated with the FRMS which have had a long and varied history of services within this area. Tentatively, the agencies and communities that will serve as data sources within this region are identified below. As in all other studies, the FRMS/ESCD Project Director and his research and evaluation staff will be directly involved with us in selecting, contacting, and gathering data from the relevant persons and groups within the region, working in conjunction with NIE project officers as appropriate. The extensive efforts to coordinate all field visitations with the FRMS Utilization Coordinators and the relevant state education departments will be respected, and their assistance will be requested in integrating contacts and data for reasons of efficiency, economy, and community integrity. Tentative data sources include:

1. The Federation of Rocky Mountain States (FRMS) Director, and the ATS-F Project Director and staff.

2. One or more of the Governors who support the FRMS and the satellite project because of its potential impact upon their constituencies and their contacts with other state representatives in Washington.

3. One or more commissioners of education and members of their staffs as they are associated with the ATS-F project.

4. One or more communities and districts served through the project, including community leaders, school administrators, teachers, and supporting personnel.

The particular community identified for the in-depth community study (described earlier in this proposal), will be Monte Vista, Colorado. This particular community has been selected because of a number of factors which appear to be highly relevant to the goals of this project. Monte Vista contains an intensive terminal (designated as IT, with two-way interactive capacity). Its project coordinator-teacher has already been appointed, and has a history of contact with this project. Monte Vista, at the north end of the San Luis Valley, is a relatively isolated community with a mix of cultural groups such as are the intended audiences for this project.

A.4 The Appalachian Education Satellite Project (AESP)

In the eastern region, the primary sources of data from the "vertical" agencies involved in the project, would be similar to those in the other two regions. Tentatively, the agencies and communities to be studied are suggested below. As in other regions, the Project Director and his evaluation staff would be directly involved in planning for and conducting all visitations and contracts with the agencies and communities studied, with the coordination of NIE project officers as needed.

1. The Appalachian Regional Commission, the Director of the AESP project, and selected members of his staff.

2. One or more state governors who are directly associated with some aspect of the AESP project.

3. One or more commissioners of education, and their staffs, as they are associated with this project within their own states.

4. The University of Kentucky and its functions serving the project in a wide variety of ways.

5. One or more of the RESA's participating in the project, with particular emphasis on the different roles played by "lead" RESA's in each triangle, and those RESAs whose responsibilities cover geographical areas that cross state lines.

6. One or more school districts who support RESA activites and within which schools are being served by AESP activities.

7. Schools and communities that have been involved with and are being served by project activities.

An extended visit will be planned to one community for the community study described above. The tentatively identified community for this study will be Huntsville, Alabama, because of its early involvement with satellite activities, because of the presence of the "lead" RESA (Tarcog), the role that it is credited with playing in the decision of the region to become involved in this AESP project, and its history of involvement in other educational projects (e.g., the EPDA Tri-state Teacher Training Project, 1970-74).

B. Types of Data to be Collected and Analyzed

The above discussions of "data sources" has tended to emphasize human sources of data who will be contacted personally. In addition, three other sources of data will be used to supplement these personal contacts with agencies and communities:

1. Information which could be provided by the regional project evaluators and research personnel either as a result of their regular activites or which could be obtained through some

reasonable expansion of these activites (and such expanded functions would be supported, as appropriate).

2. Data acquired from a study of other telecommunications projects, as this data can be justified as being pertinent to the issues involved in the present study.

3. The documents generated throughout this entire network, as they have potential for providing information relevant to the issues to be studied here. At this time, relevant documents would appear to include quarterly and progess reports, budget reports, newsletters, invitations to project meetings, consultants' reports, the reports of intra-project evaluators and research personnel, and other such documents. To assure the continuing cooperation and understanding of the regional Project Directors, it might be important to provide the directors with continuing contact with this project's activities.

C. Summary: Sources of Data

Information will be gathered from individuals, agencies and reports throughout the 5-tiered, three-region network represented by the diagram in Figure 4.4. Data will be gathered from individuals and agenices at the same level across the three regional projects and within each project across the five levels. In addition, one "target community" within each of the regional projects will be visited and studied in some depth in order to obtain a personal-experiential basis for the difficult task of analyzing and integrating the complex mass of information that will be gathered.

4.1.6 Modes of Analysis

A. How Shall the Analysis be Done? The purpose of analysis is to find order and meaning in observations and to identify and test for the presence of recurring and organizing themes. In the study proposed here, there will be two broadly defined approaches to the discovery of recurring themes. First it is possible to approach any situation with one or more sets of themes already in mind and to use those thematic structures in searching for and classifying what is observed. Second, it is possible to participate openly in a situation without predetermined categories and classifications in order to let the themes arise out of the events and relationships of the situation. In the proposed study, both predetermined and emergent themes will be used as bases for gathering information and organizing it to produce knowledge and understanding.

The framework for the analysis that will be done in this project can best be described in three phases: (a) the field analysis that takes place as each observer is in the field talking with participants, observing events, and studying records; (b) the central analysis that takes place in the EPRC as field reports are received and organized, and as suggestions go back out to field observers for additional study; and (c) the final analysis that takes place as both field and central personnel together review all of their raw data and preliminary organizations in order to find the most comprehensive meaning in the project activities.

The field-observation persons have been selected so as to be open to a wide variety of information, and they will be able to (a) record data in predetermined categories and according to established themes, (b) observe openly without predetermined themes and record complete observations in order to discover and test for emergent themes, and (c) forward data to the EPRC so that it can be examined by others. There will be analysis done at this "measurement" phase, and appropriate steps will be taken to assure that this preliminary analysis enriches the process rather than limits it through personal biases or predispositions.

The EPRC analysis (and monitoring of field collection and analysis) will be a critical function; the staff assigned this function, and the advisors and consultants who supervise and regulate this function, have been chosen to represent a variety of disciplines. The data analyst will be an experienced individual with a history of participation in computer searches, statistical procedures, and the integration of diverse points of view. The procedures involved will include the coding, counting, and interrelating of content themes from interviews, observation reports, minutes of meetings, budget reports, and other forms of data from the field. Through regular interaction with advisors, consultants, and the field observers, the organizing themes that arise out of the data will be maintained as tentative and hypothetical until the final phases of the analysis.

The final analysis will be performed by the team of persons who have been continuously involved in the project, and will have had the longest history of exposure to the events and activites. But, as this team works to bring order to their observations, they will be given opportunities to present their preliminary findings to experts from other fields who may be able to suggest new or modified ways to look at and integrate their observations. This two-stage process of drawing together data and then exposing these tentative formulations to fellow professionals from other fields is important in order to maintain integrity. It will be at this phase of the project activities that the raw data from many observations is synthesized to inform the issues that are critical to the policy analysis. The conclusions from these multiple analyses will be organized for final reporting.

B. Analytic Techniques. In the preceding discussion, emphasis has been placed on the value of being able to observe and record activities within the many organizations of the ESCD using certain predetermined themes to guide and structure thinging. Similarly, in analyzing the content of conversations, records, and reports, it is appropriate to test the utility of many themes, one after another, in an effort to extract the most meaning out of the data available.

(1) Logical Analysis. In conducting a "logical" analysis of observations and data from other sources, it is clearly important: a) to gather

data on rhetorical statements and related performance in order to test for consistency; b) to look at the logical balance between statements of priority and the relative budget support provided to the priority functions; c) to look at the breadth and diversity of activities assigned to specific individuals relative to their experiencial background; d) to examine the span of control of individuals in an organizational structure relative to the geographical distances separating the individuals or the range of intellectual disciplines or technical expertise among those supervised; e) to be concerned with the congruity of policies, procedures, and performances in an organization; and f) to look at the compatibility of means and ends, or the consistency of messages and media.

These kinds of logical analyses would also be appropriate as an observer or an analyst searches for and examines data across levels within one regional project, between sites or levels across regions, or between related functions across different telecommunication projects (e.g., comparing aspects of MPATI, the Samoan project, or the Brazilian experience with aspects of the present ATS-F project).

(2) Content Analysis. In a similar fashion when conducting a "content" analysis it is important to be concerned with either the discovery of themes that were repeatedly found in the same setting or that were observable across settings, or with the frequency and sequence of behaviors that could be classified according to predetermined themes. For example, adopting an organizational decision-making model, behaviors that could be classified as indicative of the themes of access to, participation in, and control of information, resources, and decision-making power are sought. Of course, organizational infra-structures and the changes that occur in organizations as responses to various kinds of pressures and demands are objects of content analyses.

These kinds of content analyses will be done at all levels of data gathering and interpretation, and the persons participating will have had experience from widely related fields, such as the interpretation of psychological protocols, the analysis of historical texts, budget analysis, organizational development, and others. The final reporting of project observations and conclusions will be organized around the policy issues described earlier.

(3) Rating Scales. This technique is a conventional device for estimating the position of a person or object of interest on some distribution of a particular trait. Usually they are completed by either subjects or trained observers, and they require that the trait of interest be represented on a scale (high to low, for example) and that the object of interest be assigned a position on that scale.

(4) Ranking. This device is frequently used to compare the relative position of several people or objects to each other when they are ordered in terms of some underlying characteristic of interest. For example, we can rank a series of organizations in terms of their relative degrees of responsiveness.

(5) Tabulation. This descriptive technique involves the arithmetical summation of a series of tallies such that they can be represented as a number and recorded.

(6) Subject Critiques. During the process of participant observation, subject critiques are used to guard against observer bias. Their use requires that subjects of the participant observation study be given the opportunity to read and critique in writing the summaries that have been composed by the participant observer. This technique provides a built-in check for observer bias and also allows the report of the participant study to describe the reactions of the subjects.

C. Summary: Figure 4.5 relates our methods of data collection to the appropriate modes of analysis, as they will be employed during the site studies and overall analyses. It will be noted that these methods of data collection can be directly related to our earlier discussion of the sources

METHOD OF DATA COLLECTION	MODES OF ANALYSIS
1. Literature and document review	Logical and content analysis
2. Archival search	Logical and content analysis
3. Participant observation:	
3.1 Document review	Logical and content analysis
3.2 Interviews	Rating, Ranking, Content Analysis
3.3 Checklisting	Tabulation
3.4 Interim summary	Subject critique
4. Unobtrusive measures	Tabulation, content analysis

Figure 4.5. Method of Data Collection and Associated Modes of Analysis for the Site Studies

of data throughout the network of related organizations making up the ESCD system. The sources of data include human sources from which information will be available through interviews and observations, and non-human sources from which data will be available in the form of printed documents and other media.

In Figure 4.6, we summarize our consideration of analysis by arraying our eight general research questions and three target communities together with the methods of data collection and analysis that will be used to investigate the eight questions.

4.1.7 Reporting

The final reporting of the project observations and conclusions will be organized around the policy issues which have been raised in this project's goal statements. The form of such reports will be designed to be appropriate to the content of each report and the characteristics of the audience. We intend to make wide use of different media (photographs, tape recordings, maps, printed materials, sketches and cartoons as appropriate, oral representations, and graphs and tables) and varied formats of presentation (journal articles, professional society presentations, open hearings, personal question-answer sessions, public broadcasting time, and formal project reports)--all of these in order that the conclusions reached may have the highest likelihood of reaching and influencing those who will establish policies on future telecommunication projects.

4.1.8 Time Lines and Staffing Requirements

A. Time Lines. During the first year (1974-75), we plan to work in each community on a quarterly basis, spending roughly six days on each occasion. Exceptions will be made in Alaska where, due to distance and cost, two on-site observations of 3-4 weeks duration will be conducted. The first will occur in October 1974 and the second in March 1975. "Vertical" respondents will be contracted on a semi-annual basis, e.g., September-October; March-April.

RESEARCH QUESTIONS AND TARGET COMMUNITIES SHOWING INTENDED METHODS OF DATA COLLECTION ACROSS EACH QUESTION AND COMMUNITY

Research Questions	Target Community Huntsville, Alabama	 Monte Vista, Colorado	 Allakaket, Alaska
1. What existing organizational structures were available to receive the ESCD?	1*, 3.2 ←	———	→
2. What changes could be observed in the preexisting organizations as a function of there participation in the ESCD?	2, 3.1, 3.2, 3.3, 3.4, 4 ←	———	→
3. What were the observable consequences of organizational change and/or organizational development?	1, 2, 3.2, 3.3, 3.4, 4 ←	———	→
4. Who attributes what strengths and weaknesses to the organizations of the ESCD?	1, 3.1, 3.2, 3.4 ←	———	→
5. Given the present organizational structure, what particular services were best offered?	1, 3.2 ←	———	→
6. Which of those events that occurred and others which were intended to occur but did not can be interpreted as a function of organizational structure?	1, 2, 3.1, 3.2, 3.4, 4 ←	———	→
7. Based on an examination of selected sites, what kind of organizational structures appear to be most effective for increasing responsiveness and utilization?	1, 3.2, 5 ←	———	→
8. What alternative organizational structures, or modifications in existing ones, appear to be required if a satellite telecommunications system is to be implemented?	1, 3.1, 3.2, 4 ←	———	→

* Numbers refer to Figure 4.5 contents.

During the second year (1975-76), we plan to visit each community once for a period of approximately six days, except in Alaska where selected sites will be visited in one 2-4 week period. In this second-year phase of study, it is anticipated that many of the same subjects who were observed and interviewd during the demonstration year will again be contacted and follow-up discussions initiated.

B. Staffing Pattern. We are convinced that sophistication of design and clarity of purpose are not sufficient for excellence in a field-based study. Consequently, our efforts in terms of staffing have been guided by two criteria:

1) Allocate major site-based and analytic tasks only to competent professional staff who have already demonstrated their skills in other research projects.

2) Build a staffing system relating field personnel with the office personnel who will work within the EPRC, which will be manageable, efficient, and effective for the goals of the overall study.

Analysis of the extent of our own on-site activities, the scope of vertical and horizontal articulation that will be necessary, and the consequently voluminous sets of observations and records that will be gathered, lead us to conclude that the following staffing requirements are the minimum necessary for effective implementation of our study. A description of the site-study staffing requirements follows.

1. Site Study Directors

For each of the three sites of study, there will be a site study director who will be responsible for implementing the study as described in this document, and for initiating on-site investigations and other collection procedures as time and conditions warrant. This person will direct the activities of the assistant to the site study director, and will report to the information coordinator and project director. All site-based activity, including establishing entry and conducting interviews, for example, will be performed by these persons or their assistants.

2. Assistant to the Site Study Director

Doctoral level graduate students, or their equivalents, will operate as assistants to the site directors. They will possess demonstrable competence and previous field-based experience in community study.

3. Information Coordinator

One information coordinator will be employed to coordinate the activities of the site directors, to facilitate the circulation of information between sites, and to organize the submission of data for analysis subsequent to this collection from the sites and other sources. This person will report to the project director, and operate to insure the articulation of site-based information within the broader-based policy analysis.

4. Data Analyst

One professional data analyst will be employed to be responsible for the direction of the reduction, coding, and analysis of field data. It is anticipated that this person will have had previous experience in content analysis, psychological scaling, and electronic data processing. The data analyst will report to the project director and will work closely with the information coordinator.

5. Data Clerk

The data clerk will be responsible to the data analyst and will perform technical tasks under direction. The data clerk will render data, code information, perform category sorts, carry out tabulations, and maintain a storage and retrieval system.

6. Site Study Secretary

This secretary will perform the professional secretarial tasks required by the activities of the site-study agents.

4.2 OTHER PROGRAMS AND PROJECTS

As was mentioned previously, the ESCD is seen as one source of information about the organizational issues mentioned in the first part of this section. Although a significant share of our resources will be used in studying the ESCD, we plan to consider the same kinds of organizational issues within the context of other projects. One of the projects is a thing of the past, others are currently operational, while others are only in the planning stage.

Most of this research will be conducted through a review of documentation. Where possible and appropriate, we will conduct interviews with project participants and make site visits. What follows,then, is a list of the kinds of projects and programs which we plan to investigate with regard to the organizational issues described in the ESCD study.

1. Midwest Program on Airborne Television Instruction:

A school-based experiment in instructional television which is structurally similar to a satellite-based telecommunication system.

2. The Electric Company:

The most interesting of the Children's Television Workshop projects, because it is designed to be used in schools (as opposed to Sesame Street which was originally designed for home use).

3. NHK - Japan:

High school level instructional television with our emphasis on their plans for expansion and use of communication satellites.

4. Open University: England

Consideration of the role of media in external higher education. This study is of particular importance because of their considerations of the possibility of reducing the role of broadcast instruction.

5. Samoan Project Using Televised Instruction:

The much trumpeted 'breakthrough' in the use of the media for instruction appears to have experienced significant changes in the last few years. We would want to investigate the reasons for these changes.

6. Hagerstown - Maryland:

Again a follow-up look at an exemplary program of the 60's which appears to have undergone radical transformation.

7. Australian Broadcasting Commission - Education Department:

The use of mediated instruction for rural isolated populations and instruction in areas where there is a shortage of experienced teachers.

8. Brazilian Satellite Project:

The planning and program operation of a highly political satellite-based educational project.

9. Communication Technology Satellite User Experiments:

The joint United States and Canada project where all user experiments are in the planning stage. Projects of particular interest will be

(i) Regional medical education
(ii) College curriculum sharing between certain Canadian and U.S. universities.

10. SUN Project:

A developing organization at the University of Nebraska which has plans to become a regional, media-based university.

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APPENDIX 4.A

A SYSTEM VIEW OF ORGANIZATIONAL EVALUATION(1)

4.A.1 INTRODUCTION

General systems theory can provide a holistic schema for thinking about the large number of interacting factors which influence the operation of the overall ESCD project. In the following paragraphs, a systems model of the project will be developed beginning with an elementary set of system components then linking together clusters of these basic building-blocks to construct an overall model. The value of such a model for this proposal is that its elements and interconnections can be directly related to the types of data that will inform the policy issues which are basic to this evaluation proposal. The simplifications made in translating the "real world" into the model were guided by the earlier exploration of the relevant policy issues. Therefore, the model structure directly reflects the interests of those who will gather, analyze, and interpret information on the performance of the system.

4.A.2 AN ELEMENTARY SYSTEMS UNIT

Each component of a "system" can, itself, be considered as a sub-system. In the present study, the smallest unit to be examined will be what has been called the "target community" (the fifth or lowest level in the 5-tiered diagram presented earlier). In a highly simplified form, this target community can be represented by the classical systems model shown in Figure 4.A-1.

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(1) In many ways, the following discussion is consonant with the concepts presented in the FRMS Working Paper, "An Analysis of the Significant Events Associated with the Planning, Development, Implementation, and Evaluation of the Satellite Technology Demonstration," Feb. 12, 1974. The high degree of agreement between plans proposed in the present document and ideas developed in FRMS Working Paper is further support for the value of close coordination between this evaluation effort and the activities to be conducted within the three regional projects.)

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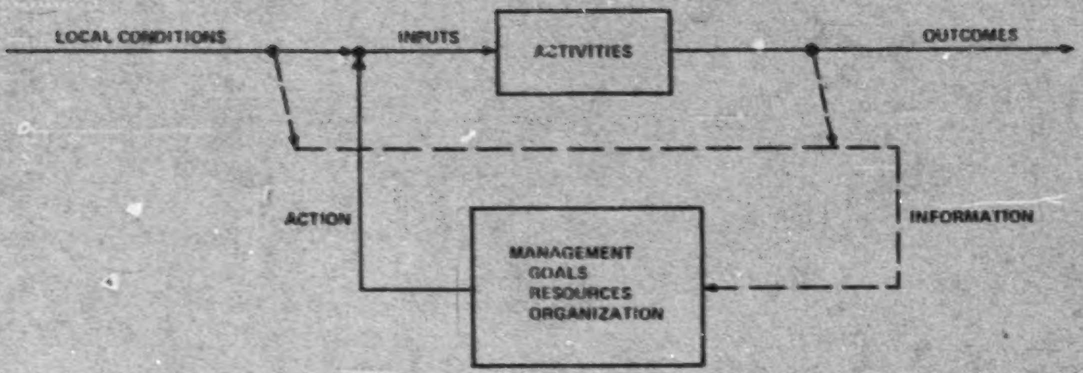

Figure 4.A-1. The basic system model representing inputs, activities, outcomes, and a management component that monitors conditions and outcomes and takes actions to achieve its goals.

Using this basic model to represent selected aspects of the local school and its community, the "activities" represent the within-school processes, and "management" represents the local groups which receive information on the local conditions and outcomes and take action through their organization and resources to modify the activities in order to achieve their goals.

In a traditional "evaluation" effort, an evaluator would assess changes in outcomes (particularly changes in learner performance) following the introduction of an innovation, such as an ETV program, into the school setting. In sharp contrast, the present proposal intends to observe and report the effect of organizational structure on the acceptance of the ETV innovation and, conversely, the impact of the innovation on organizational structures. Thus, in the diagram in Figure 4.A-1, above, rather than concentrating on the input-activities-outcomes relationship, attention

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would be focused on the changing nature of the interactive relationships within this basic systems unit and the flow of information, resources and power throughout this mini-system over the time period of the project.

4.A.3 A SYSTEMS MODEL OF INTERACTING UNITS

Extending the simple diagram of Figure 4.A-1, a systems model can be constructed showing several such basic units in an interactive relationship. Figure 4.A-2, represents two local communities (at the same "organizational level") and the "higher level" organization which is related to the local communities. The task in this more complicated diagram is to represent the

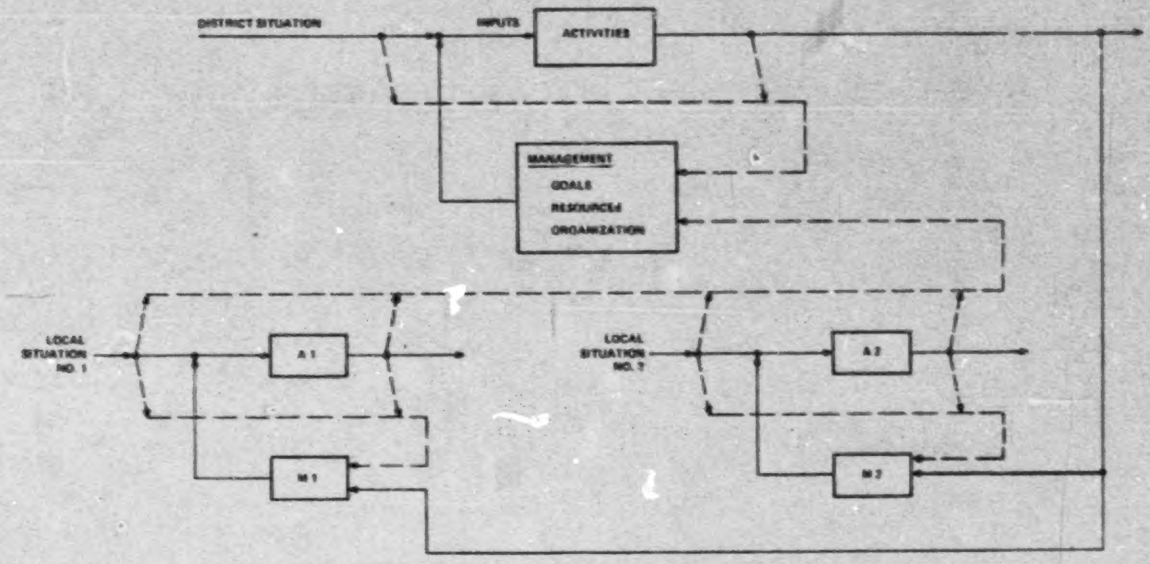
DISTRICT SITUATION
INPUTS
ACTIVITIES
MANAGEMENT
GOALS
RESOURCES
ORGANIZATION
LOCAL SITUATION NO. 1
A 1
M 1
LOCAL SITUATION NO. 2
A 2
M 2

Figure 4.A-2. A systems model representing two local communities interacting with a district organization in such a way that information flows from the local groups and the actions flow from the higher level organization down to the local communities (a system with limited access, participation and control).

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nature of the interactions among these organizational components of the larger system. In Figure 4.A-2, as in the earlier diagram, the dotted lines represent the flow of information (with the arrow head indicating the direction in which the information moves), and the solid lines indicate the movement of actions and resources; in this sense, actions may include participation in decision making and the allocation or consumption of resources.

As can be noted in Figure 4.A-2, the higher level organization receives some information from both "lower" level organizations but provides no information to them on its conditions, goals, resources, organization or outcomes. In a similar manner, the distict organization is represented as taking actions relative to the local communities (providing goals, resources

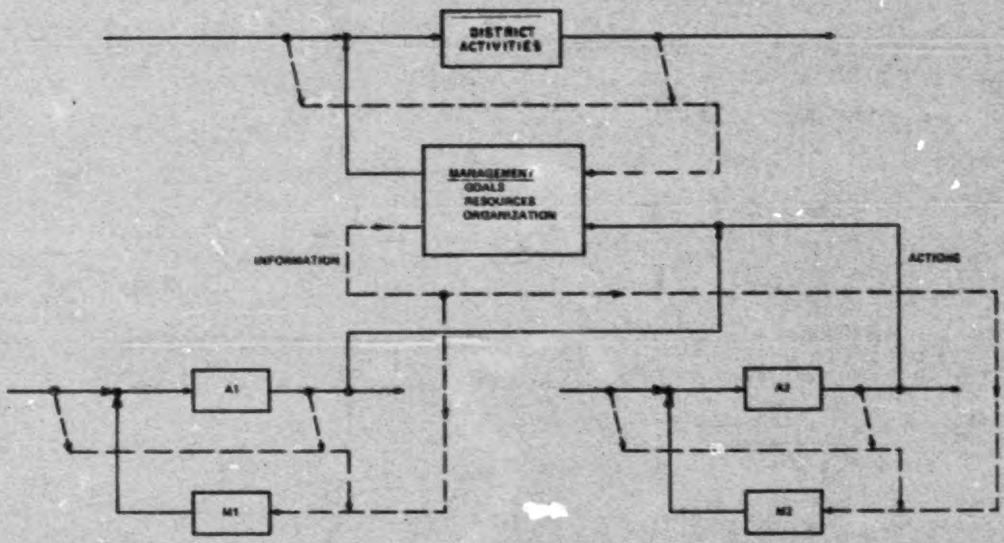

Figure 4.A-3. An alternative system configuration which contrasts with that shown in Figure 4.A-2. In this situation, both information and action move in directions opposite to that shown in Figure 4.A-2.

and organization; e.g., specifying the size and format of the School Board and providing money, curriculum materials and facilities), but the actions of the local communities do not influence the district organization.

An alternative organizational relationship that could exist between these system units is shown in Figure 4.A-3. Here, information is shown flowing "down" the organizational hierarchy, and the influence of actions is shown moving "up" the hierarchy. The actual situation is some combination of 4.A-2 and 4.A-3.

These types of diagrams are very helpful in the proposed study, as an aid to the study designer in identifying the themes to search for in, observing events and talking with persons from each organization within the system. These diagrams lead one to ask about the nature of the information that flows from the local community, the source from which it comes, and the degree to which local persons influence or control this information about each aspect of the local sub-system. The diagram is also a stimulus to design methods for determining how this information is received by the other organization and what uses are made of the information provided (the participation of that organization in using the information to which it has access).

4.A.4 RELATIONSHIPS AMONG MANY ORGANIZATIONS

In the ATS-F Demonstration, it is recognized that there are multiple organizations functioning at several different levels; the simplified overall diagram of Figure 4.4 suggests the multiplicity of agencies involved. For example, the five tiers of organizations include:

1. Federal agencies; NIE, USOE, NASA, BIA, etc.
2. Regional agencies; FRMS and ARC.
3. State level agencies; the Alaskan Governor's Office of Telecommunication, the many governors of the states, each state's education department, and other state-level organizations.

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4. Intermediate agencies operating between the state organizations and the target communities; universities, associations, RESA's, and others.
5. Target communities; the district organizations and the local schools and communities.

Extending the diagrams developed in Figures 4.A-1, 4.A-2, and 4.A-3 to encompass representative organizations at each of these five "tiers" would result in a complex diagram which would not contribute substantially to the comprehensibility of this report. Instead, it is proposed that for any organization in the system, it is possible to design assessment instruments which will seek data on the nature of the interactions of that unit with other related units. A general model for such a representative "system unit" that is helpful in designing instruments and analytical frameworks, would appear as shown in Figure 4.A-4.

The six points identified in Figure 4.A-4 are points of possible interaction with other organizational units within the system. The follow-

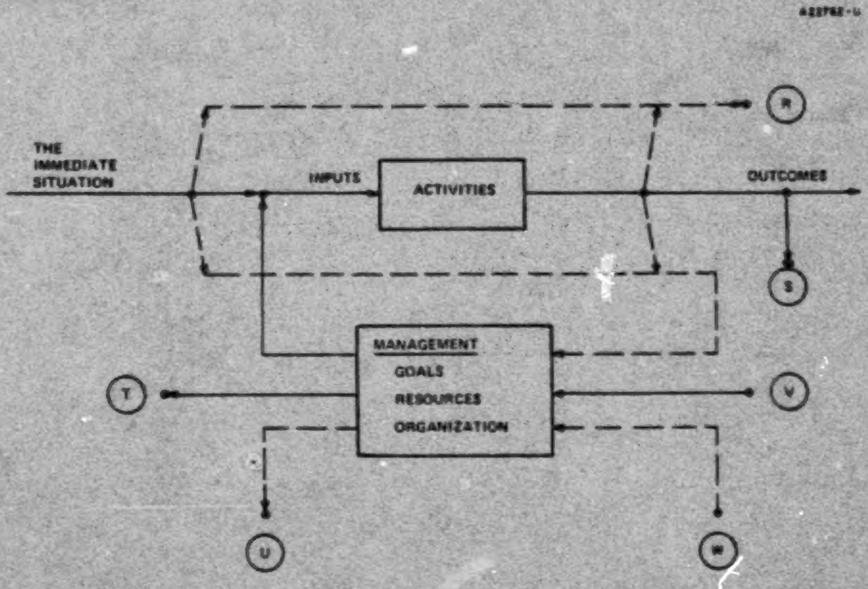

Figure 4.A-4. A representative organizational unit in the system indicating six types of data that would help in understanding its relationships with other similar units.

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ing types of data could be gathered and analyzed relative to each of these six interconnecting points:

R. There would be information on the immediate situation and the units' outcomes that would be availabe to other organizations without monitoring or control (or even awareness) by this unit.

S. The outcomes of this unit, i.e., its actions, may directly influence other units in the system. For example, the action of units at the federal level provides hardware and money directly to lower level organizations, and sometimes impacts directly upon their organizational structures as well.

T. Those participating in the management functions of this unit may have the chance (and may take the opportunity) to participate in the decisions of other groups. This action may be through individuals rather than through the organized action of the entire unit. For example, members of a local school board may be given funding to attend the meetings of a district or regional organization and may have a chance to vote on the allocation of that organization's resources.

U. Information on the state of this unit (its performance goals, resources, and limitations) may be supplied to other organizations by the management function of this unit through oral and/or written reports. In this form, they are monitored and controlled by the management function and, therefore, may differ from information at point "R."

V. The actions of other organizational units may impinge directly upon the management of this unit in the form of resources (or their limitations), attempts to modify goals and organizational structures, or the provision of new technologies and/or equipment (e.g., the satellite TV hardware and software).

W. Information from other units may be received by (be available to) this unit on a wide variety of topics, e.g., goals, resources, outcomes, etc.

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4.A.5 OVERALL SYSTEM PERFORMANCE

The preceding discussion has focussed on events that may take place within the boundaries of the ECSD project. The "systems" way of thinking also leads one to ask about the overall performance of the system in terms of its inputs, organizational structure and outcomes (as though the overall system can be represented by the simplified diagram of Figure 4.A-1).

From this point of view, it is cogent to examine the basic themes of:

Inputs:
- Dollar costs
- Human investments of time and talent
- Facilities and hardware (e.g., the satellite)

Outcomes:
- Utilization
- Impact on target audiences
- Intended and unintended impact on other audiences

Structure:
- Responsiveness
    - Changes in structure
    - Changes in content for special needs
    - Responses to crises
    - Development over time

4.A.6 SUMMARY

The systems approach to understanding the development and operation of the ESCD project provides a cognitive framework for thinking and acting relative to the people and events of the project.

Thus, a series of observations and interviews within an organizational unit of the system would be designed to elicit information about a wide range of interactions that unit could have with other units in the system. An examination of the systems diagrams constructed to represent significant aspects of the system provides guidance to the construction of the observations and interviews for collecting data and to the design of analysis procedures for synthesizing the information obtained.

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APPENDIX 4.B

4.B.1 DATA GATHERING, THE PATTERNED INTERVIEW

A variety of means will be used to obtain the information needed to provide an empirical base for the policy analysis and recommendations that will be the outcomes of this study.

The particular method being dealt with in this Appendix will be the patterned interview. Ultimately, a complete set of patterned interview protocols will be established, so that similar questions can be asked of different persons throughout the system, allowing comparisons among multiple responses to the same stimulus questions.

The general procedure will be:

1. An interview schedule will be established with the regional project coordinator, to ensure minimum disruption of on-going field events.

2. The content of all interviews will be coordinated with the Regional Directors in order that interviews can be designed and conducted to meet the needs of both the Regional Director and this evaluation study. This will require coordination of both the content and method of all interviews.

3. Interview responses will be coded so that the particular respondent's name will not appear on records (written by the interviewer) from the interview. All data will be kept confidential, regardless of requests for specific identification

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from any source. Information from interviews will not be used to make any modifications in the on-going projects.

4. The interviewer will ask the specific questions listed in the guidelines developed here, in order that persons throughout the organization will be known to have been given the same stimulus questions. Guidelines will also be given on how to explore for further information, after presenting the basic foundation questions. Writing as rapidly as possible, the interviewer will write down what is said, while it is being said; reliance will not be placed on the memory of the interviewer. These records will be coded with symbols to indicate the characteristics of the interviewee that are relevant to this study. All records will be made directly on McBee cards (or similar forms) to minimize later transcribing. After each interview, the interviewer may add comments to the records made during the interview; these added comments are to be specifically identified. The primary data from the interviews will be the on-the-spot recordings.

5. Following each interview, the interviewer will do these four things:

   a) Summarize the main points of the interview, in order to assure the respondent that the data was received, and to get confirmation that these were the main issues.

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b) Offer to answer any questions from the interviewee, and provide as open and honest answers as possible. When the interviewer does not have the information requested, he/she is to say so, and suggest the respondent ask appropriate persons in the regional project.

c) Follow up the contact with a personal note of appreciation to the interviewee.

d) Send a note to the responsible person confirming the occurrence of the interview.

4.B.2 THE GENERAL FORMAT OF AN INTERVIEW

Each interview will follow, approximately, the sequence given below. The purpose of this uniformity is to establish a degree of control over the data gathering situations.

> (It is recognized that some interviewers prefer an unstructured interaction with an interviewee, in order to let the structure of the situation evolve as a function of the local situation. While this has some desirable features for some kinds of interviewing, it is not totally appropriate for this project, in which the responses of persons all across the USA are needed to specific questions in order to compare and contrast their responses. In addition, it will be desirable for the interviewer to follow up each patterned question with open-ended enquiries, to elicit individualistic responses. In all situations, it will be important for the interviewer to be open, accepting and supportive of the persons being interviewed.)

0. Warm-up
   Social conversation, before getting to relevant information
   Introduction to the purpose of this conversation
   Respond to issues concerning procedures and privacy.

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1. Initial Contacts	Earliest information about ESCD? What conditions was it designed to improve? Were those conditions really a problem? What organizations were doing relevant things, then? Adequacy of existing organizational structures, then? Changes made in organizations, to work with ESCD? What were the purposes and the possibilities for ESCD, then? Your impressions of the strengths/weaknesses of ESCD, then?
2. Initial Involvement	What did you first do, relative to ESCD? Meetings? Readings? What were the conditions, then? Structures and responsibilities of the groups involved, then? Who was doing what, specifically, relative to ESCD? What results were achieved, then? Impressions of helps/hindrances in reaching those results? What promises did ESCD appear to have, then?
3. Current Involvement	What is the situation in which ESCD is now operating? What changes have taken place? Organizations? Activities? Goals? Results of those changes? Why? Nature of current organizational structures in ESCD? In your particular organization? How related to others? With current structures, what could best be achieved? What are most significant activities, now? What results have already been achieved, through ESCD? What changes are needed in order to achieve ESCD goals?
4. Anticipated Futures	What conditions do you anticipate, two years, from now? What ESCD activities will still be going on? What results do you anticipate will have been achieved, then? What will help/hinder achievement of these results?

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If someone wanted to build on the best of what's happening, who could make that decision?

5. Close-off

4.B.3 OUTLINE OF A TYPICAL INTERVIEW

0.0 Warm-Up

0.1 I appreciate the chance of talk with you. It was good of .... to arrange for us to meet.

0.2 Today, I'll be talking with you about the Satellite Television project, how you have been involved in that project, and your perceptions of the organizational structure that has been built up around this project. Later, you might have some questions you'd like to ask me about the project--and then I'll answer just as honestly as I can.

0.3 Before we get started, tell me what you have heard about the study I am part of, and why I am here talking with you, now.

0.4 The interviews and observations we are making, are an attempt to describe the ways in which the organizational structures of groups participating in this project have influenced the results that are being obtained. We will not be evaluating either the organizations or the results, and no one will be using anything we observe in an attempt to change what is going on, now. Our purpose is to gather data that may be useful to some future government agency, that may think about using some kind of telecommunication system to help in the development of a region, a country or a group of countries.

0.5 We will be talking to about 100 people in each of the three regions (Appalaichia, the Rocky Mountains, and Alaska), and at all levels from local schools to the Federal government. Our group is composed of University persons and independent consultants, all of whom are completely independent of any of three regions that are participating in the project. We have been funded by a group not directly involved in the operation of the project. But we have been given full cooperation and support by everyone in this project.

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0.6 I asked to talk with you, because (the honest reason, put into a favorable light.)

0.7 All interviews will be confidential. I will be making notes about your comments, but your name will not be attached to these notes.

0.8 You will not see anything changed, here, because of anything that you or others might say to us, now--but we hope that future projects like this can be helped to be more effective because of what we have been able to find.

0.9 Do you have any questions, before we begin?

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions.
Use follow-up items provided

1.0 Initial Contact with ESCD

"I'd like to know about your first contacts with the ESCD (or local name). I'd be interested in HOW you first heard about it, WHAT you first learned, what you DID about it, and your first IMPRESSIONS of it.

"Tell me about your first contacts!"

(Write down all that the other says, as rapidly as you can, to demonstrate the importance of everything said.)

Let the other talk for some time.

Then, use the follow-up questions, below, to get specific information. Write each response on a separate card, keyed to your questions, but don't ask for data already supplied.

1.1 INFORMATION

"From WHOM did you hear about ESCD. What organization? What person?
"Who were you, then? Position?
"Did you try to get more information? What happened, if you did?
"What did you do with your information?
"Who did you tell about ESCD? Why not others? Who else was telling about it?

1.2 RESOURCES

"What kinds of things were available to you, then? Money, materials, help, expertise?
"What did you do, then? Such as answer questionnaries, give your opinion, contribute time or work?

1.3 INFLUENCE OR CONTROL

"What organizations were involved in ESCD at that time?

Search for
these themes

Access
Participation
Control

Information
Resources
Power

Diversity
Uniformity

Consistency
Balance
Congruence
Compatability

Systems
- Components
- Interconnections
- Boundaries
- Inputs
- Outcomes
- Feedback
- Delay in feedback

Culture
Values
Perceptions
Integrity
Dignity

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions. Use follow-up items provided.	Search for these themes
1.3 INFLUENCE OR CONTROL (Continued) "How much say did you or your group have, relative to any ESCD activities? "Who did you think really decided what was needed, and what would be done? 1.4 CONDITIONS "What was going on around you, that ESCD was supposed to help improve? "Were those conditions really a problem? "What problems were you concerned about, then? 1.5 TRANSACTIONS "What changes seemed necessary, for you to work with ESCD? "Did you think those changes would help or hinder you and your organization? If either, in what way? "What kinds of things did you expect you and others would be doing? 1.6 OUTCOMES "What did you think the real promises and potential from ESCD might be? "What were your impressions of the strengths and limitations of ESCD, then?	Access Participation Control Information Resources Power Diversity Uniformity Consistency Balance Congruence Compatability Systems Components Interconnections Boundaries Inputs Outcomes Feedback Delay in feedback Culture Values Perceptions Integrity Dignity

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions, with these follow-up items	Major Themes To Be Examined
2.0 INITIAL INVOLEMENT WITH ESCD	
"Good---that gives me a good picture of your first contacts with this project.	
"Now---tell me about your first INVOLVEMENT with the project. WHEN were you first connected with it---under what CONDITIONS were you involved---what ACTIVITIES and CHANGES were going on or were you a part of---and what were your EXPECTATIONS for the project, at that time?	Access Participation Control Information Resources Power
"Tell me about the first INVOLVEMENTS you had with the project."	Diversity Uniformity
* *	
(Write down everything said. Label each separate card with the question number to which the person is responding.)	Consistency Balance Congruence Compatability
* *	
2.1 INFORMATION	Systems
"What new things did you learn, then? "How did you get the information you wanted or needed? People, meetings, reports, rumors? "How did you give information about your activities, ideas, and needs? Were you asked, or did you have to push? "Was it easy or hard to find things out? To tell others?	Components Interconnections Boundaries Inputs Outcomes Feedback Delay in feedback
2.2 RESOURCES	Culture Values Perceptions Integrity Diginity
"What resources were available to you, when you first began? What did you actually use? Money, influence, facilities, special help? "What were you doing relative to the other people and groups involved in the project?	

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions, with follow-up items

2.3 CONTROL OR INFLUENCE

"Did you have a chance to influence or change what was going on in the project, then?

"Did you have a chance to decide on certain issues or to determine who would make certain decisions? Goal setting, needs analysis, material development? Budgets or budget distribution? Plans, schedules, evaluations?

"Who decided that you would participate, and what you would do?

2.4 CONDITIONS

"Under what conditions did you think you would be working, when you were first involved.

"What kinds of things were actually going on around you, related to this project?

"What other projects were going on, or had been active, that made a difference?

"What seemed to help or hinder what you and your group were doing?

2.5 TRANSACTION

"What did you originally think you'd be doing, as part of this project? What was your group supposed to do? Others?

"What did you actually do, and what about the others you worked with? Elsewhere?

"Could you tell me about what was actually going on, throughout the project, then?

"Tell me about what you thought would happen, and what actually did."

2.6 OUTCOMES

"When first involved, what kinds of outcomes were expected—what results were anticipated?

"How did you think these outcomes would be noticed or measured? Who could tell the difference?

"What kinds of things were actually coming out of the project activities? How could people tell? Who was reporting what?

* *

(Before going on, check to be sure you have data relevant to the major themes that will be used to examine and compare different people's comments.)

* *

Major Themes To Be Examined

Access
Participation
Control

Information
Resources
Power

Diversity
Uniformity

Consistency
Balance
Congruence
Compatability

Systems
- Components
- Interconnections
- Boundaries
- Inputs
- Outcomes
- Feedback
- Delay in feedback

Culture
Values
Perceptions
Integrity
Dignity

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Ask these questions, with follow-up item	Major Themes To Be Examined
3.0 CURRENT INVOLVMENT	
"That's fine. I can see how you were first involved. "Now,---I'd be interested in your CURRENT activities and relationships with the ESCD project (or the local name). "I'd be interested in:	Access Participation Control
What people thought things would be like, now, and how they get to know what things are really like,	Information Resources Power
What's going on between the various groups involved compared to what was intended, and who has any influence on this,	Diversity Uniformity
The results that were hoped at this time, and what results are actually being achieved, now, And what has helped or hindered in all of this."	Consistency Balance Congruence Compatability
* (Write it all down, using separate cards keyed to each of the question areas.) *	Systems Components Interconnections Boundaries Inputs Outcomes Feedback Delay in feedbac
3.1 INFORMATION	
"Tell me about the contacts that you thought you'd have with the other parts of this project and what information is actually available to you. Local school, other agencies, regional groups, etc. "How do you decide what information you pay attention to and use in your work? "What degree of control do you exert on the kinds of information that others get from you and your group? Can you get all the information you want? Can you be sure others hear what you have to say? Are there times you can refuse? Demand?	Culture Values Perceptions Integrity Diginity

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions, with these follow-up item	Major Themes To Be Examined
3.2 RESOURCES "What resources did you think you'd have, compared to what you actually have available? Time, money, materials, special skills. "What would it take to really do the job that you think could be done, now? "What helps or hinders you from getting these?	Access Participation Control Information Resources Power
3.3 INFLUENCE OR CONTROL "To what extent can you or your group influence what is happening in your part of the project? Influence what others are doing? Flow of information, resources, results? "What decisions can you make about: program content, schedule, audiences? "How is the budget for your operation, decided? How much can you spend, on your own say-so?	Diversity Uniformity Consistency Balance Congruence Compatibility
3.4 CONDITIONS "Right now, what things or events help or hinder the achievement of project goals? "What changes have taken place? Is this about what you expected, earlier? "How would you describe the overall environment in which you are trying to get things done? Tell me about your own organizational structure?	Systems Components Interconnections Boundaries Inputs Outcomes Feedback Delay in feedbac
3.5 TRANSACTIONS "What had you thought would be happening now, and how is that the same or different than what is happening? "Tell me what you know about what's happening at other places throughout the ESCD? "What activities would make a big differences, if they were done right now?	Culture Values Perceptions Integrity Dignity

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions.
Use follow-up items provided

3.6 OUTCOMES

"What kinds of results do you see, now?
"Is that about what you expected for this point in time? How or how not?
"What would be effective indicators of what is really happening — what the real outcomes are?
"Who knows what's really happening? How does he? In schools, communities, regions, states, etc.
"What changes would be required to really achieve ESCD goals?

4.0 ANTICIPATED FUTURES

"Yes — that tells me where things stand in your activities.
What do you think will happen, from here? Over the next two years?
"What will be the good and bad things left over when this project is finished?
"What will happen to the hardware, the program materials, the organizations, the communication patterns?
"If someone wanted to build on the best of what has happened, who could make that decision?

****

4.1 INFORMATION

"Who do you think will really know what was going on and what the results really were?
"How would you find out, if you wanted to?
"How could people compare the actual outcomes with the original intentions of the project?
"Why do you think the real results might not be known?

4.2 RESOURCES

"What will happen to the experience that people will develop through this project? Lost or used?
The hardware and program materials?
The organizational changes that have taken place?
The communication patterns that have developed?
"How could someone build on all of this?

Search for these themes

Access
Participation
Control

Information
Resources
Power

Diversity
Uniformity

Consistency
Balance
Congruence
Compatability

Systems
  Components
  Interconnections
  Boundaries
  Inputs
  Outcomes
  Feedback
  Delay in feedback

Culture
Values
Perceptions
Integrity
Dignity

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OUTLINE OF A TYPICAL INTERVIEW (Continued)

Ask these questions.
Use follow-up items provided.

4.3 INFLUENCE OR CONTROL

"What do you think will determine what happens after this project is over?

"Where will the critical decisions be made? By whom?

"How much will your group have to say about what happens, here?
How about you, personally?

"What would it take to change all of this?

4.4 CONDITIONS

"What do you see for the situation, or the environment for projects like this, over the next few years?

"What major events do you see as being critical, in determining what will happen?

"What about things like information flow, the distribution of resources, and the exchange of influence, control or power over local activities?

4.5 TRANSACTIONS

"Who do you think will be doing what, a few years from now?
Local, district, state, region, federal?

"If someone wanted to continue the best of what has happened, who would have to do what?

"What do you think you will be doing, in a few years?

4.6 OUTCOMES

"And what do you think the real outcomes will be?

"What will be the good and the unfortunate outcomes?
Locally?
At the district or state level?
For the region?
At the national level?

"As of now, what do you think would be required from everyone involved (including yourself) to make a project like this was intended to be a really effective thing?
What would help or hinder, in that?

****

(Check for data on major themes.)

Search for these themes

Access
Participation
Control

Information
Resources
Power

Diversity
Uniformity

Consistency
Balance
Congruence
Compatability

Systems
  Components
  Interconnections
  Boundaries
  Inputs
  Outcomes
  Feedback
  Delay in feedback

Culture
Values
Perceptions
Integrity
Dignity

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5.0 CLOSE-OFF

"It's been good to have the chance to talk with you.
"Thank you.
"But, there may be some questions you would like to ask of me.
If I can answer your questions, I certainly will.
If I can't, I'll either admit I don't know or will try to tell you why I can't answer. Sometimes the best answer to a question might come from someone with whom you normally have contact.
"But now, how can I help you?

****

(It will be extremely important to make this invitation, and to handle the questions as openly as you can. Questions on local procedures or request for specific help should be referred to the local organization. Do not put yourself into the position of being a "go between."

When finished, express personal thanks for the time and the information.

After the interview, write out additional notes. Review the records and add to them as needed to have them carry the message you received.

Within the next 24 hours, send the respondent a personal note of appreciation.

SECTION 5

FISCAL ORGANIZATION, DEMAND AND UTILIZATION RESEARCH AREA

5.1 FISCAL ORGANIZATION STUDY

One absolutely crucial set of questions which is raised in dealing with any kind of educational telecommunications system concerns who would pay for it. Clearly, if no one wants the system sufficiently to pay for it, then there will be no such system. Unfortunately, the question is not a simple one; nor is it simply or directly answerable. In fact, there does not even appear to be a legitimate straightforward way of asking the question. For instance, it would be tempting to seek answers to the rather direct questions: who wants an educational telecommunications system, and how much are they willing to pay for it? The "answering" of such questions is, of course, methodologically difficult to say the least. And the answers derived from such a study would, unfortunately, not be useable. Consider the following:

First, a fairly large scale educational telecommunications system--such as the ones which satellites necessarily entail--requires a large number of different users. But telecommunications systems represent limited resources: essentially the number of channels, the geographical locations where these channels are made available, and the 24-hour day. Hence, it is not sufficient simply to aggregate the different possible users and the amounts of dollars they are willing to contribute for inclusion in such a system and then compare this to the cost of the system. Some of the users may be mutually exclusive. For example, the demand for use of the system may be focused on the "prime time" hours in which school is in session. Demands must be aggregated, but this has to be done within the constraints of the technical capacity of the particular system under consideration.

Second, there is a related set of considerations which has to do with the fiscal organization of such an enterprise. Briefly, if we assume that the federal government would not be willing to pay for the entire telecommunications system, it is important that we consider the ways in which local and regional groups could collect the funds to pay for the system. This, in all probability, would require the creation of the new sorts of regional, multi-state organizations and networks which were examined in the preceding section. The questions which must be covered include:

a) Development of the fiscal or financial sub-components of a regional system. This could involve state departments of education, counties, cities, and school districts. The organizational question here is: who pays?

b) A related question concerns the development of guidelines or techniques for determining how much each of these users should pay.

c) There are questions of inclusion which could be of extraordinary consequence. Our preliminary studies indicate quite clearly that a large-scale telecommunications system can be effective only when it is quite fully used. The inclusion issue arises when one considers the possibility that, say, only two-thirds of the eligible school districts (those that would fall within the "footprint" or rebroadcast coverage area) would want to participate in the program, but that some 90% would have to participate to make the system financially workable. These problems could probably be handled, except for the problems of exclusion discussed below. It should be noted, though, that in the commercial domain, past experiments with broadcast pay TV have been less than successful. It is only now, with the development of various cable-based systems that pay TV looks like an economically feasible proposition.

d) There is also the problem of including those who would like to contribute financially to a program, but who might not be able to do so for a number of reasons. In some instances, there might not be any mechanism which would allow for their contribution, e.g., as in the case when individuals want to support a particular commercial television program. In another instance, it might be difficult or impossible to aggregate possible contributors prior to the commencement of that program.

e) There are questions of exclusion. The issue here is whether or not those who decide not to contribute financially to a particular service can be prevented from utilizing that service. If the technical or physical means for exclusion does not exist, then revenue collection can become problematical. Private enterprise cable television offers an excellent example of an excludable service, while broadcast television is a good example of a non-excludable service, since it is difficult to prevent anyone with a receiver and within range of the signal from taking advantage of the service. We are aware of instances where this problem has arisen with respect to public broadcast television's transmission of daytime educational programming for schools. The problems of exclusion may be more servere when considering the possibility of a private enterprise system.

f) We would tend to consider the exclusion problems with respect to schools amenable to federal but not state or local control. But we would consider the exclusion principle as it relates to the conduct of teachers and their possible use of video tape recorders for unauthorized duplication of proprietary programs to be difficult to handle. The current use of xerox and mimeograph machines by teachers at all levels of the education systems seems to be a substantial indicator of the range of exclusion problems.

g) There are other questions which overlap with our legal and legislative study, and they include the consideration of precedents and limitations on state departments of education and school districts to enter into long-term contracts for the delivery of services.

5.2 DEMAND STUDY

One of the most obvious ways of answering questions about possible future demand for some kind of educational telecommunications system would involve a traditional market research study. We have considered and discarded this option for a number of reasons.

1. Traditional market research is usually oriented to the merchandising of products rather than services. Accurately gauging reactions to services which are new or not clearly understood is most difficult. This is one of the reasons for the unexpected lack of interest in services like the Bell Picturephone. Market research and forecasts just did not foresee the possibility that there would be only 500 service customers in 1974.

2. A new technique does not always have an obvious advantage for the final user. The decision to make extensive use of communication satellites for long distance telephone communication would not have been of much relevance to the final client. Of course, it is possible that costs might be reduced or cost increases diminished, but the input of telephone users might not be relevant for the final decision. For this reason, it is important to distinguish between the technique (e.g. satellites) and the service advantages and disadvantages they might offer to the range of possible participants.

3. From another point of view, the marketing approach is quite inappropriate. Market research aims to maximize the penetration of

> particular products within particular markets. Whether the product has really significant advantages over other products is often a matter of debate. Corporate survival often takes precedence over the interests of consumers. For this reason, it would seem that this approach is inappropriate for governmental use. It is inappropriate because government must be clear about the advantages and disadvantages of possible new services. The questions which government must answer are what are the benefits, and who stands to gain? Only after these questions have been answered appropriately is it legitimate to move into more traditional marketing modes.

For the reaons cited above, our study of the demand for various telecommunication or satellite-based services will be based on a careful examination of the changes which are most likely to occur. This is in opposition to a stance which considers all possibilities equally probable. Our approach will be elaborated in the discussion of the utilization study.

5.3 UTILIZATION STUDY

As mentioned earlier, it is our belief that future experiences of educators with various telecommunications devices will include many of the problems which were experienced in the past. For this reason we believe that the study of current successes and failures of various educational technologies will inform us about possible future developments in this area. The utilization of satellite-based services will need to overcome current prejudices and eliminate shortcomings inherent in current uses of technology for educational purposes.

We will concentrate on three areas of investigation. The first will consider the extent and manner of current utilization of various technologies which might be relatable to a telecommunications system. The second will consider trends in that utilization, whether there is an increase or decline in utilization, and the reasons for those possible changes. The third area will consider the costs and benefits which might eventuate from any satellite-based telecommunications system as it influences existing uses of various technologies for educational purposes.

The entire investigation is constructed on the assumption that sudden wide-spread innovation is unlikely and that change and improvements are more likely to be of an incremental character. These incremental improvements are most likely to occur if they do not involve a radical change in resource allocation or major re-organization of existing institutions. In other words, this investigation will consider the character, goals and problems of the infrastructure which currently utilizes various technologies. Various kinds of satellite-based telecommunications systems will be considered as they might make incremental improvements in that system.

It should be noted that this study has certain structural similarities to the technical and cost studies described in Part A, Section 2. The differences are important. The technical and cost study focuses on developments which are outside the schools or other possible participating institutions. This study concentrates on what is the case and what might happen inside schools or other participating institutions.

5.3.1 Current Utilization of Various Technologies for Educational Purposes

The past twenty years has seen much experimentation and program development with a wide range of devices which might be part of a telecommunication system. This part of the study will investigate the extent to which these devices are used and the manner in which they are integrated into various institutional structures.

It will be important to discover how many of these technology-based projects are in operation. For example, we will collect data on the utilization of:

- ITFS systems
- Public television-based broadcast television and radio services
- Closed-circuit television services within schools and other institutions
- Cable T.V. used for educational purposes
- Computer services for instruction and management

This part of the study will consider the range and focus of utilization. For example, it will investigate the grade level or age of students, the subject matter, whether it is an interactive process, the institutional arrangements, and the intensity of institutional commitment. Other areas of investigation will include the source of programming, the way in which consumers pay for the services, and crucial factors which encourage or discourage utilization for particular purposes.

5.3.2 Utilization Trends and Possibilities

This part of the study will consider the trends in the utilization of these various technologies. Reasons for the decline or increase of utilization will be carefully sought out. Current projects which are in the developmental stages and which show promise for continued utilization will also be investigated. Both the TICCIT system developed by Mitre Corporation and the PLATO system of the University of Illinois are major projects which would be investigated. Other sources for this investigation would be, for example, the planning and development sections of the Corporation for Public Broadcasting and the Children's Television Workshop. We would also expect to consult in this area with many of the persons and organizations mentioned as possible informants for other parts of the study.

It is easy to be transfixed by the present state of affairs and neglect to consider possible areas which might be amenable to some kind of utilization of telecommunications-based services. (Most discussions of technological possibilities do the opposite and neglect the reality of the present). One way we plan to overcome this difficulty is to consider the way in which certain functional modes of telecommunication systems might be of some value to a range of possible clients. For example, some functional modes of telecommunication systems are:

a) Real time delivery of
  (i) Television and audio materials, e.g., ITV -- one way.
  (ii) Television and audio materials, e.g., ITV -- interactive
  (iii) Computer interactions, e.g., CAI.
  (iv) Person-to-person communication, e.g., counseling, training, diagnosis.
  (v) Computation services.
  (vi) Document retrieval and transmission.

b) Nonreal-time delivery
  (i) Television and audio materials.
  (ii) Computer-managed instruction.
  (iii) Batch processed computation.
  (iv) Document retrieval and transmission.

These can be arrayed against various characteristics of client groups who might be

c) geographically isolated
d) in transit - migrant farm workers
e) concentrated at particular locations - Indian reservations
f) widely dispersed - medical practicioners.

These few categories allow us to generate a range of possible uses which particular kinds of telecommunication systems might have.

Possible candidates for preliminary analysis would be:

(i) English as a second language
(ii) Education of the handicapped

(iii) Indian education
(iv) Enrichment programs for isolated schools
(v) Medical education and re-education
(vi) Professional development
(vii) Family education
(viii) Migrant education
(ix) Open university
(x) Parent education
(xi) Retirement activities

5.3.3 Benefits of Telecommunications Interconnection

The third part of this study will consider the costs and benefits to be had from some kind of telecommunications interconnection. Obviously telecommunications can have little impact on the utilization of a whole host of unsophisticated technological devices used in educational programs. The autonomy and portability of such devices can be considered to be their strength. Devices of this kind include film loop projectors and film strip projectors. But as the devices become more sophisticated and their operation becomes more expensive, it is possible to see the growing benefit of resource sharing and hence cost sharing. The regional and national development of curriculum materials is an example of this kind of process. Similar kinds of benefits can be considered for the sharing of other kinds of resources whether it be in the form of computer assisted instruction or in the ownership of computer equipment.

While interconnection has obvious benefits, it also has obvious negative consequences. In certain circumstances, the benefits arising from the economies of scale which interconnection allows also mean that individual choices are limited. No single school district has the resources to produce more than a few minuites of an Electric Company program, yet the Electric Company approach to reading instruction may not be shared or appreciated by some reading teachers. Admittedly the teachers now have a choice where they had none previously.

The opportunities and constraints which different kinds of interconnection systems will raise will be considered in cost, technical, political, legal and organizational terms. The thrust of the analysis will be what kinds of improvements could an interconnection system make given some understanding of the most likely behavior of various formal and informal educational institutions?

SECTION 6

FEDERAL POLICY ISSUES AND OPTIONS

6.1 INTRODUCTION

Policy decisions, whether made at the federal or the local level, tend, by the very nature of the political process, to deal with marginal changes. A local school principal may decide to buy a video recorder or hook into the local cable network. A federal agency may decide to buy part of the time of a communications satellite for educational uses. Usually, it is not open to either the local principal or the federally-based decision-maker to design and fund an educational telecommunications network for the U.S. The changes and the opportunities for change are much more piecemeal than that. Nevertheless, through the accumulation of incremental changes, the U.S. may find itself the possessor of such a system, perhaps without benefit of forethought.

There is a sense in which the policy analyst, if he is to be useful, must address himself to the arena in which current decisions are being made. That is, he must examine the alternative policies which suggest certain marginal changes from the status quo and help the decision-maker to choose among them. But it is an equally important function of the policy analyst to point out where the incremental decisions are leading and to explore whether or not the place we are headed is one we really want to reach.

As we have said earlier and repeatedly, the EPRC views the entire proposed effort as an extended and comprehensive policy analysis of the educational potential of satellites and telecommunications. The preceding analytic sections were selected and developed in order that they might shed light on the fundamental policy goals and issues. As such, it is a partial misnomer to describe this section as being concerned with policy issues and options. This section can more properly be viewed as the drawing together of the work of the preceding sections.

In this effort we will be concerned with synthesizing the information, ideas, and analyses of the prior work. As such, it is most difficult to discuss in any very satisfactory detail the precise manner in which we would conduct this final and most crucial element of our inquiry. We do not yet know the costs of the alternative technical systems, nor how well they might perform technically. We do not know what various legal and legislative problems might be raised by such systems. There are clearly a number of very fundamental questions which relate to organizational development and interactions and prospective utilization and demand which must receive at least partial answers before we can begin to lay out the priorities for this culminative investigation.

Nevertheless, there are some important matters which we can address now. We can look at the federal government, at its goals, at the purposes of federal educational activity, and at the modes of federal intervention. And we can identify a few issues which our initial consideration of the problem suggests are of central concern.

6.2 THE FEDERAL ROLE

6.2.1 THE GOALS AND PURPOSES OF FEDERAL EDUCATIONAL ACTIVITY

Only in the last decade has the federal government actively entered the domain of elementary and secondary education. Although the Constitution reserves responsibility for education to the states, arguments for federal intervention can be developed on the grounds of "national interest" and "general welfare". These arguments have supported such programs as the National Defense Education Act. Programs for special populations have strong constitutional and judicial backing under the First Amendment--equal rights under the law. Efforts to provide incentives and sanctions to insure equal access to educational opportunities raise few questions about the legitimacy of federal action. Still, federal rights and responsibilities in education remain somewhat unclear. Demonstration projects can be understood, in some ways, as the generation of experience and understanding of new domains which might be a legitimate federal responsibility.

The major educational goal is, of course, learning. The problems concern what should be learned and what to do to help people learn. Federal goals have focused on encouraging learning by: (1) providing learning opportunities or services; (2) the development of planning and management capabilities for providing the services; and (3) making learning opportunities available for special populations, defined by social characteristics (such as low family income or homes where English is not the native language) or personal characteristics (such as physical or mental handicaps).

At least two major problems have plagued the administration of federal education programs since 1965: 1) the ambivalence of incentive structures for comprehensive planning and management of the educational system; and 2) difficulties in selecting criteria for success in multi-purpose programs. Although federal agencies have offered verbal encouragement for system change, especially in the areas of finance and the needs of the disadvantaged, the fragmentation of federal programs has militated against coordination and integration of educational services. In addition, although funds are provided for federal staff programs, little attention has been paid to anticipating management needs or assisting in the development of necessary administrative competencies. It could be argued that this most crucial lever (and one of the least costly) for the improvement of education has had lowest priority.

Furthermore, programs such as Title I, besides aiming to serve the disadvantaged, also aim to provide learning services and to improve learning outcomes. In program evaluation, success is most frequently measured by improvements in student learning as measured by objective cognitive tests--measures that offer inconclusive and ambiguous guides.

By examining the history of past federal educational activities we can, perhaps, shed light on our basic policy question: What should the Federal Government's stance be with regard to educational satellites and telecommunications?

6.2.2 MODES OF FEDERAL POLICY DEVELOPMENT

It is obvious to say that policy research should be relevant to the needs of policy-makers. It is less obvious to say what this implies for practice, for there can be no denying that policies are formulated and reformulated in a multitude of mysterious ways. We propose to order our research in such a way that it relates to what we believe are five modes of policy development.

These five modes of policy development are listed and elaborated below:

(1) Leadership

This mode of policy development concerns the various ways in which agendas and priorities are presented to different publics. In this way, governmental interests are tested and formalized at a very general level. Sometimes this leadership function is carried out in press conferences, in political speeches, in addresses to professional associations or special interest groups.

Reactions to these ideas can be gauged, and as a consequence, constituencies are formed both for and against the possible action or initiative. This phase does not necessarily involve the expenditure of new funds, but often leads to pressure to allocate funds in certain ways at some time in the future.

Because this leadership phase builds constituencies, it often means that the possible future course of the idea or initiative is to a large degree set. It could be argued, for example, that the presentation of communication satellites as most suitable for rural isolated populations, both raises the expectations of the representatives of those populations and makes other uses less likely.

So in this phase of policy development, it is of utmost importance to be clear about the consequences of presenting certain possibilities to particular constituencies. Careful policy analysis would aid in the identification of constituencies and possible areas of application which might not be intuitively obvious. For example, it is quite possible that the education of the handicapped might be one area where satellite-based educational services could be most appropriate.

Policy analysis would also develop some preview of not only the benefits, but also the costs of presenting the idea or possibility to other constituencies. For example, if the satellite system were to be monopolized by the core, formal educational institutions, it is possible that the less organized, informal institutions and organizations might be denied the possibility of developing innovative activities.

(2) Coordination

The use of various "coordinating" strategies seems to be an important policy option when dealing with educational telecommunications. There are at least three levels of coordination which have implications for the current project.

The first involves the coordination of various programmatic thrusts within one area, such as education, and within one agency. This strategy is an obvious choice when resources are limited and a critical mass cannot be achieved in any other way. This kind of strategy can sometimes lead to operations where the outcomes are more than the sum of the individual parts.

The second more difficult strategy involves the coordination of programmatic activities across traditional agency boundaries. This kind of coordination becomes more worthy of careful consideration when there is the need to make large resource commitments with the eventual aim of significant cost savings. (These two sets of issues have been part of much of the discussion of the proposed Allied Services Act.)

The third type of coordinating activity is not one of direct Federal coordination, but rather the possibility of regional coordinating and planning consortia. Two of the three ESCD projects utilize these kinds of organizations. It would appear that with technological innovations which reorganize the traditional constraints of space and time, there is a growing need to understand more clearly the benefits and costs of these kinds of organizations. For this reason issues of regionalism will be a major theme of our study.

(3) Research and Development

Research and development can function in a number of ways. It is most obviously some kind of search for knowledge or expertise, but R&D also can place particular issues within certain contexts. The way in which researchers from particular disciplinary bases are encouraged or discouraged when it comes to soliciting research can have a profound effect on the way in which problems are first of all defined, but more importantly solved.

Another less recognized aspect of the R&D activity is the ability of such exercises to rapidly create constituencies for particular kinds of activities. For example, no one has carefully thought out the way in which the Carnegie and Ford Foundations created constituencies with explicit expectations for what was originally called Educational Television and which we now know as Public Television. It is regularly assumed that the original Foundations involvement was beneficial, but it is possible to argue that the expectations created for this noncommercial television led to its being an imitation of commercial network television. Maybe there were more appropriate models which would not have required substantial centralized funding procurement. It is only now, many years later, that careful thought is being given to ways in which Public Television can be self-supporting from the local level.

Policy analysis can then place the issues within alternative frameworks and can provide some ways of predicting the consequences of particular choices. This kind of analysis would also place the problems and possibilities within a historical perspective so that R&D can avoid reinventions of the wheel or inventions of square wheels, and it can sometimes lead to the development of the equivalent of air cushion transportation. These issues are obviously of direct relevance to the mandate of NIE.

(4) Programmatic Revision

Existing programmatic intentions can often be effectively advanced in ways which were not originally considered. New or improved social/technological organizations might be appropriate ways in which programs can be made more effective. To this end, the modification of existing legislative guidelines is one way in which technological opportunities can be realized.

An example of this kind of endeavor is the current attempt to rework the Broadcast Facilities Act so that a wider range of organizations might participate in the development of a wider range of services.

A striking example of the way in which existing legislation can become focused over the years can be seen with Title I of the Elementary and Secondary Education Act of 1965. Over the years, the role of parent and community groups in the governance of local schools became more and more prominent. It is this gradual refinement of existing programmatic initiatives which we would consider under this category.

(5) Legislative Development

The most obvious outcome of policy research and analysis is the informed development of new legislation. Yet it should be clear that whether or not legislation is finally developed is not the important issue. The knowledge and understanding gained in such a study can be usefully applied in any of the other four modes of policy development described above.

6.3 POLICY ISSUES

The EPRC's approach to the ESCD as one demonstration of the potential role of educational telecommunications in the U.S. led to our seeing more clearly than we otherwise might have the implications of the ESCD and other like projects for a number of important educational issues. Some of these issues are perennial ones such as equal educational opportunity, pluralism, and individual freedom and privacy; while others are more specific: the reaction of teacher associations to the new technology and the appropriate role of private enterprise in this venture, for example. These issues have become part of the fabric of our research design, but we wish to aggregate and emphasize them here so that our focus may be directed finally to the bigger picture of which the ESCD is a part.

The following is a working checklist of policy issues considered during this phase of the project. It is neither comprehensive nor conclusive:

(1) Regionalism

1. Will regional organizations be able and willing to bear the cost of a regional telecommunications system?

   A regional system could involve state departments of education, counties, cities, school districts. Who pays?

   What guidelines or techniques can be developed for determining how much each of these users should pay?

   Are regional organizations a more cost-effective way of providing services than states and local units?

2. Do regional organizations create a situation in which new technologies are more likely to be used than they are in situations where each school acts on its own? Reasons for thinking that this might be the case include:

(a) the sense of commitment to a larger effort,

(b) the ability to discuss and solve problems with those working at other sites,

(c) a greater concentration of funds which makes it possible to have:

1. the help of regional personnel
2. more polished and sophisticated programming than a local school would be able to provide.

3. What new uses of regional organizations might emerge in the future? What new services could they provide?

4. What other ways might there be to define a "region" other than geographically?

5. What negative effects might result from the emergence of regional organizations?

(2) Equal Educational Opportunity

State equalization of inputs (Serrano/Rodriguez). Could regional telecommunications systems be a way of equalizing inputs? Smaller, less wealthy schools or geographically isolated schools could receive courses in areas where they cannot afford a full-time teacher.

Telecommunications systems may be helpful in providing equal access for special populations; e.g., the handicapped.

(3) Pluralism/Uniformity

1. Cultural pluralism: What procedures were used in the ESCD to involve representatives of local cultural groups in decisions on the content and methods presented in the materials broadcast?

Will the Alaskan project succeed in using satellite programs to reinforce local cultures and native languages?

2. Curriculum: To what extent will the use of telecommunications programming tend to make the curriculum more uniform?

3. Do the movements toward individualization of instruction clash with the organizational and technological characteristics of the communication system? How does this relate to the declining utilization rates of broadcast instructional television in U.S. schools? Can the interactive capacities of the satellite system help solve this problem?

(4) Cost Savings

Can telecommunications systems be used to increase the productivity of the educational system?

(5) Access, Participation and Control

1. Consider the implications of the ESCD project for the existing structures of the schools. What are the implications of their reaction for the acceptance or rejection of the project and subsequent success or failure of the ESCD project?

2. Increased participation in the local decision-making processes: (a) Is this goal really compatible with the organizational requirements of satellite technology; e.g., regional delivery systems? (b) Will increased programming quality be viewed as a satisfactory trade-off for decreased local control? (Will the production of software by new regional organizations be viewed by teachers/students/community members as increasing local choice, or as decreasing local choice by taking the

production of course materials out of their hands? That is, will the local participants believe that they have more or less access to, participation in, and control of the educational system with the presence of regional organizations?)

3. "Big Brother" Issues: What dangers to individual freedom and privacy arise from the two-way capabilities of satellite and cable systems? Are fears of surveillance, "cabletapping," and message tampering well-founded?

(6) Pedagogical Innovation

Can we identify unusually effective schools, i.e., schools in which there has been greater enthusiasm, greater user acceptance of the satellite? How can we identify the factors responsible for this difference? Some candidates might be:

(a) Imaginative uses of the media made by individual teachers at particular sites,

(b) Organizational changes within the school which the use of the media has forced (N.Y.'s O.E. Performance Review found that "sound managerial practices and instructional leadership" makes a difference in reading scores--the nature of the interaction of the in-school variables makes a difference.)

(c) Commitment of the school administration to the ESCD.

(7) Teacher Unions

1. Consider the attitudes of teachers and teacher unions to a technology which could impinge on their authority within the schools and decrease the number of teachers needed. Are they likely to thwart such an innovation? Under what circumstances would they see it in their interests to cooperate?

2. Will teachers be threatened by the emergence of new organizations (such as the Consumer Committee in Alaska) for monitoring the educational process?

(8) Provision of New Services

Will the new organizational structures connected with telecommunications systems be more amenable to nonschool-bound services such as pre-school child development, continuing professional education, and special education than present structures have been?

(9) The "Technological Imperative"

"What can be done must be done." One of the consequences of a lack of careful policy analysis has been the repeated ways in which technological possibilities have been automatically translated into technological goals for education. A whole host of devices have been short-lived candidates for revolutionary change, but the heaven on earth did not eventuate, and there was little gained from the experience.

(10) Methodological Problems

1. Attributional problems: What demonstration outcomes are related to the presence of the satellite and satellite services?

2. Generalizeability: In what ways is the experience of these demonstrations generalizeable to other, future circumstances?

6.4 POSTSCRIPT

Throughout Phase II, it has been the goal of the EPRC to develop a research design in which the research we proposed would be clearly related to educational goals which might be worthy of attainment and to ways in which policy decisions get made. We have emphasized again and again that we view the entire investigation as a policy analysis. Our research design must demonstrate what we take policy analysis to be--if it does not, we have failed.

What we can do is summarize a few of the points which we have made along the way about the goals of policy analysis:

1. To provide the synthesized results of substantive research in a form which is useable by the policy-maker.
2. To examine the goals, both explicit and implicit, of a particular project and to ask "Is it worth it?"
3. To bring the viewpoints of different stakeholders to the attention of decision-makers.
4. To help coordinate current research efforts.
5. To bring the experience of past projects to bear on current and prospective ones. This is one reason we have consistently maintained that the ESCD is only one source of data for our policy analysis.
6. To assess and examine the current project from the perspective of generalizeability. (What we are concerned with is discovering the ways in which the experience of the demonstrations is generalizeable to other future circumstances.)
7. To consider the potential consequences of alternative policies. (Where does each policy lead?)

Obviously, the Educational Satellite Communications Demonstration presents an excellent opportunity to undertake a comprehensive study of the use of telecommuncations systems to deliver educational services. Such a study is long overdue.

PART B

OPERATION STRATEGIES

SECTION 1

ADVISORY COUNCIL

An advisory council will be formed. It will be composed of seven persons outside of government who will provide critiques and guidance to the project. We expect that the membership will contain skills and interests in communications, education, social science methodology and the policy sciences. The advisory council will meet with project staff six times during the project

At present no-one has been asked to join the council. If an award is made to EPRC and when budget negotiaions are completed, we will approach these and other similar experts.

What follows is a list of persons who might be invited to join. The list is not final, but it does give some idea of the persons who we consider would be suitable.

Dr. Nanci Gonzalez
Chairwoman, Department of Anthropology
Boston University

Dr. Wilbur Schramm
East-West Center
Hawaii

Dr. Edward O. Moe
Director, Center for Urban and Rural
Community Development

Dr. Robert Shayon
Chairman, Department of Communications
University of Pennsylvania

Professor Eugene N. Aleinikoff
School of Law
Rutgers University

Professor Ralph Bolgiano
School of Engineering
Cornell University

Dr. Margaret Chisolm
Chairwoman, School of Library Science
University of Maryland

Dr. Helen Redbird-Selam
Teaching Research and College of
Education, Monmouth College

Dr. Ithiel de Sola Pool
M.I.T.

Professor Kan Chen
of Systems, Man and Cybernetics Society of
Institute of Electrical and Electronic Engineers

Professor Donald P. Ely
Center for the Study of Information and
Education, Syracuse University

Mr. Robert Burtman
Lincoln Laboratory
M.I.T.

Dr. George Gerbner
Annenberg School of Communications
University of Pennsylvania

SECTION 2

INTERNAL REVIEW

In our preliminary proposal we described the multi-disciplinary nature of the EPRC. Mention was also made of the variety of projects which have been undertaken for a range of clients.

One operating strategy which the EPRC has used with success involves a process of critical review of work in progress. Working documents are distributed to all staff, to relevant members of other divisions of SURC, and to faculty members and advanced graduate students at Syracuse University. Luncheon sessions are then arranged so that the work in progress can be critically discussed.

This process has several benefits. It allows for the scrutiny of ongoing work from a variety of perspectives, and it encourages discussion across formal project boundaries. Although we do not claim that this process is unique to the EPRC, we do believe that these kinds of interactions are a significant factor in the clarification and development of our work.

SECTION 3

DISSEMINATION

It is clear that the utility of the sort of investigation we are proposing to embark upon is highly dependent upon the manner in which the results are disseminated. There appear to be a large number of ways to "go wrong" and perhaps a much more limited range of ways in which to "go right." Probably the majority of such investigations have resulted in lengthy and complicated tomes, written in highly technical terms, submitted to the project's sponsor at the end of the contract period. Most such reports collect dust on bureaucratic bookshelves. Other investigations have been highly publicized, have engendered considerably controversy, and have involved the confounding of diverse and conflicting agendas.

The EPRC, obviously, has no intention of creating a dull and semi-comprehensible document. Nor do we have any desire to produce a solid, cogent and well written document which will be largely ignored.

There are very straightforward steps which can be taken to avoid both these pitfalls. The first is that different written reports will be designed and developed for different audiences within the federal government as well as in the broader educational community. The second is that report preparation can be the basis of conferences, workshops and review sessions. This would provide for both dissemination and useful feedback. The third is that presentations and articles will be prepared for both professional and scholarly groups. Our first judgement suggests that the American Association of School Adminsitrators, the Association for Educational Communications and Technology, and the American Association for the Advancement of Science would be appropriate forums for the issues and ideas with which we will be working. These formal modes will be developed in conjunction with other less formal working and information sharing relationships. Already we have built up an extensive network of persons and organizations who have both expertise and interest in the areas of our investigation. We would see that network as a growing and useful resource and method of dissemination.

The dangers and risks of this investigation becoming embroiled in a variety of different agendas and interests is far more problematic. But crucial distinctions must be made on this point. A study of the sort proposed will lead inevitably to some honest disagreements of a methodological and interpretive nature. This is unavoidable, but not undesirable. As we noted in the introduction to this document, we have no false illusions of arriving at final and absolute answers to the difficult and complicated issues posed by educational satellites and telecommunications. But the EPRC does have every intention of substantially elevating the level and quality of the ongoing debate. This, of course, can be done by developing better information and by suggesting better and more comprehensive modes of analyzing the data. Towards this end,we would plan to make our primary data available for secondary analysis.

The troublesome problems associated with an inquiry of this nature have more to do with the strong likelihood that some of the conclusions will conflict with the particular set of interests of particular individuals and organizations. The EPRC policy on such matters is one of "diplomacy", especially with regard to the three regional ATS-F demonstrations. We wish neither to add to their difficulties, nor to become a factor in the outcomes of their efforts. This would call for very considerable discretion on the part of the EPRC staff, not only in terms of the release of preliminary findings prior to the conclusion of the demonstrations, but also in terms of the unintended side-effects of collecting data while the demonstrations are in progress. But we must emphasize that we are not involved with a traditionally conceived evaluation of the ESCD. Rather, our interest is in the potential of satellites and educational telecommunications. For this reason we see our interests and the interests of the ESCD participants as having considerable consonance.

In summary, the EPRC views the issues surrounding the possible use of educational satellites and telecommunications as being of considerable seriousness and importance. We also believe that important decisions about these issues will need to be made in the next several years. To this end, we would expect that our investigation would become a significant part of the public discussions of the issues.

SECTION 4

PERSONNEL

Allocation of personnel to the particular research areas is detailed in Figure 4.A. The research areas correspond with the sections outlined in Part A of this document.

- Task 2 - Technical-Cost Research Area
- Task 3 - Legislative-Legal Research Area
- Task 4 - Organizational Research Area
  - 4A - ESCD Study
  - 4B - Other Programs and Projects
- Task 5 - Utilization, Demand, and Fiscal Arrangements
- Task 6 - Federal Policy Issues and Options
- Task 1 - Management

Except for those names asterisked, all named personnel are currently employed by the Syracuse University Research Corporation. Their biographical summaries were attached to the preliminary proposal.

In the event of a contract being awarded, and at the completion of negotiations, offers will be made to non-SURC employees.

ALLOCATION OF PERSONNEL

PERSONNEL		Task 2		Task 3		Task 4A		Task 4B		Task 5A		Task 5B		Task 6		Task 1	
		Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2	Yr.1	Yr.2
SOCIAL SCIENCES																	
DEWITT	PERSON/MONTHS	1.6	0.8							1.6	0.8			0.8	0.4	1.2	1.2
WHITE								6.0	3.0					1.5	7.5		
CLASBY				0.7	1.3									0.4	1.6		
WEBSTER								0.6	0.4					0.2	0.8		
BALDWIN*				0.85	1.6												
ROOT						6.0	6.0										
HAYNES				1.5	3.0									0.75	3.75		
RESEARCH ASSISTANT		5.2	2.6	2.6	5.2	7.75	7.75			2.6	1.3	1.3	2.6				
RESEARCH ASSOCIATE										8.0	4.0	4.0	8.0				
SENIOR RESEARCHER														2.0	10.0		
ENGINEERING																	
COLE	PERSON/MONTHS	2.6	1.4														
LOTHES		2.6	1.4														
DATA ANALYST		8.0	4.0														
CONSULTANTS																	
HOKE	DAYS					20	10										
KELLY						82	43							5	25		
JAMISON, M.		175															
SJOGREN*						33	17										
MISCELLANEOUS		17	8	10	20	20	10			33	17	17	33				
ADVISORY COMMITTEE																	